TELEPHONE ENGINEER

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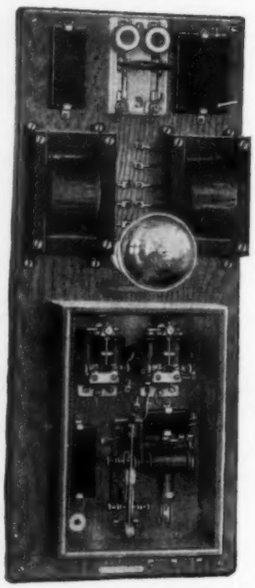

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VOL. XXIII *Chicago, March, 1920.* *No. 3*

The Southern Convention

NOT attempting or pretending to accomplish anything but extend the hand of Independent friendship and cooperation to the great but unfamiliar South, it is apparent that the association's midwinter convention in Georgia accomplished its purpose. It has shown the southern operators the advantages of membership in the great national organization. It has shown them that the U. S. I. T. A. is truly national, and not merely in the New York-to-Kansas City sense so often thrust upon the term by northern organizers. And incidentally, perhaps it has given the northern visitors a better conception of what southern cooperation can do for them, and what special and attractive opportunities exist below the Mason-Dixon line for telephone operators and supply dealers.

Wireless Progress

THE radio telephone has a lot of remarkable achievements to its credit since the war forced its development, but in some ways its most remarkable performance is the one announced only the other day, when a little set of ⅓-kilowatt power, according to the report, talked successfully over some hundreds of miles of unwired space. If a New York man can talk to a Chicago man with one of these little sets as readily as the telephone company could set up a wire connection over the same distance, it is evident that, so far as those two users are concerned, the wire has a successful rival. It is also evident that, if there were an infinite number of different wave lengths to which an infinite number of private sets could be tuned, the competition would be well worth studying.

But there are not an infinite number of wave lengths. Supposing there are 50 that can be used; the number of possible subscribers to the wireless service who could use their instruments at the same time would be limited to 100—or 50 pairs. That would be the limit not only for the direct communication, say between New York and Chicago, but for all the rest of the country within the sending radius of any of those sets. Pittsburgh could not talk to St. Louis while all those wireless "trunks" from New York to Chicago were busy.

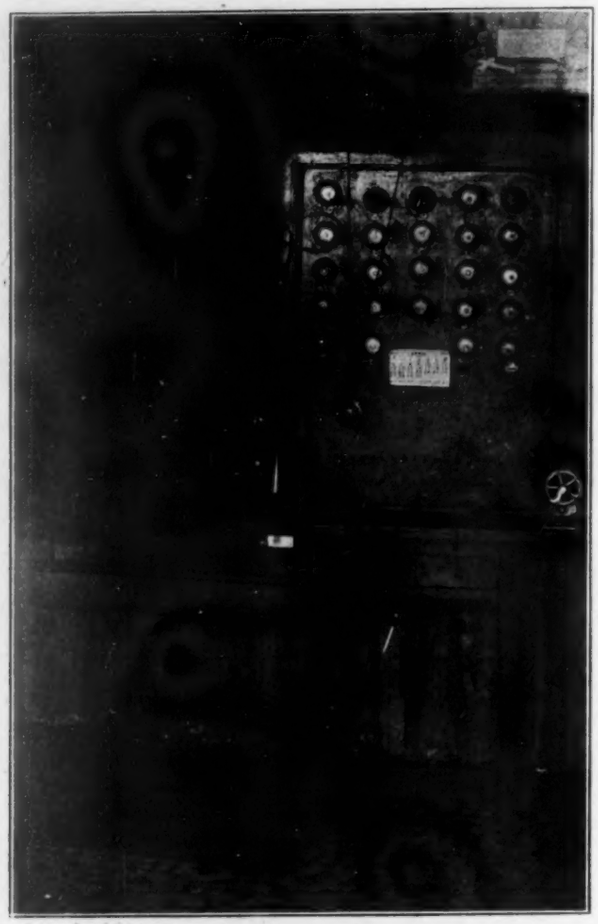
Nevertheless, there is something in this idea of wireless trunks that might stand further thought. Given a definite number of wave lengths to divide up among specific communication lines, the radio sets could be used as terminals of long-distance "circuits," just as the cross-country lines are used now. The New York man, with his regular local telephone set, simply would lift his receiver and ask for the Chicago number he wanted, and the operator would give him the first wave length not busy. If they were all busy, he would have to wait until one was available. So far as he was concerned, the proceeding would not differ from an ordinary long-distance call on a wire.

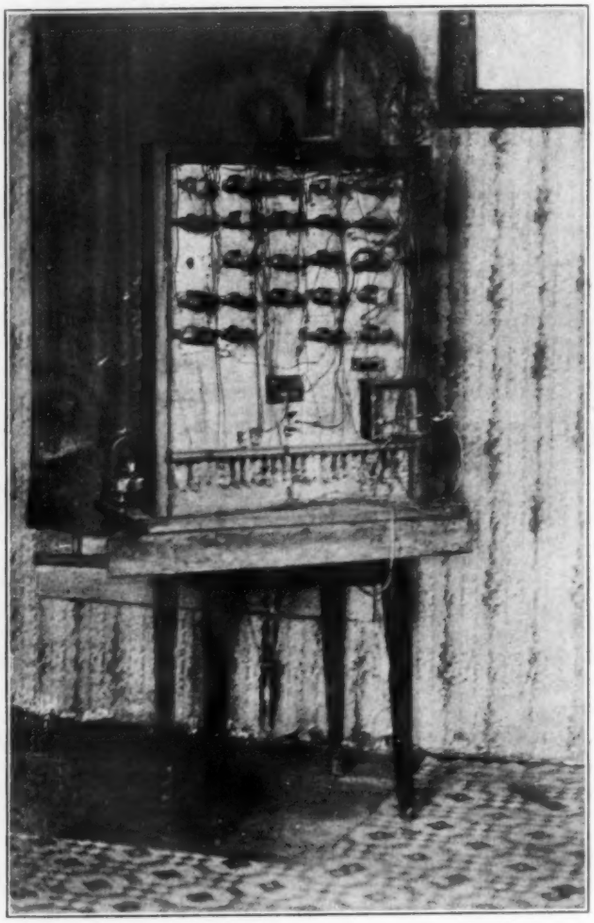
In spite of our early scorn, it is plain that the only obstacle in the way of serious wireless competition with wires is the relatively scanty supply of selective wave lengths. That seems an insurmountable barrier to the further progress of the radio as a public utility. But none of us is nearly so willing to cry "impossible" now as we were a few years ago.

Machine Telephones

WHETHER the Kansas City undertaker deserves all the credit or not, it is becoming apparent that the mechanical operator is coming into its own. Some of the biggest cities in the land will be served by the switching machines before another five years have passed. Whatever merit there be in the claims of those who see in this change only a natural evolution toward improvement, the fact of the matter is that necessity is dictating a very large part of the situation. Obtaining girl operators in adequate numbers for the demands of city service, and at wages on which anything like a reasonable rate can be based, has become well nigh an impossibility.

Machine telephones in the big cities will help the situation some by reducing the total demand for female employees, and making more operators available for the exchanges that remain manual. Without regarding the comparative merits of manual and automatic systems, and basing the argument solely on the operator question, it would seem probable that development of machine switching installation to a certain point will aid other installations to remain manual, by providing them with operators.





The picture at the left above shows the front of the switchboard of the George K. Means Telephone Company, which is located eight miles west of Martinsville, Ind. This board is about eighteen years old and was designed and built by Mr. Means. This board has some unique features. The front of the board is composed of a 1¼ poplar board and holes are bored through. The plugs are made of twenty-penny spike nails that fit in the holes in the front of the board, which compose the sleeve side of the line. These nails make contact with a piece of brass or tin that forms the tip side of the line. The cords are wrapped around the nails and are taped on so as to hold them secure. One plug is used for the answering and ringing. When a connection is made the operator obtains the number and uses the ringing plug to ring the called party, then she plugs the two lines together with a pair of cords that are bridged together. If she desires to listen in on the line she touches the ringing and listening plug on the pair of cords that are in use and she can listen. All joints are placed under screw heads. The cord weights are composed of small pulleys fastened on to a hickory stick that gives them the weight to pull the cords back in place.

The view at the right shows the back of the board. There are no drops used, ringer movements being used for the signals. These ringers are of various resistances and are bridged across the lines at all times. There are no repeating coils on the board. Mr. Means has about 150 subscribers connected to this exchange. Attention is called to one of the plugs hanging half way below the key shelf and the floor. This is one of those twenty penny spikes. The photos are reproduced by courtesy of the "Telephone Bulletin" of the Indiana Telephone Association, Max F. Hosea, editor.

The central picture shows the picturesque figure of the modern telephonized airman. With this equipment Ensign Harry Sadenwater, in a seaplane 150 miles away at sea, talked with Secretary of the Navy Daniels in his office in Washington. The telephone is of the noise-proof "Magnavox" type described in this magazine some months ago, and is undisturbed by the roar of the Liberty motors close by.

South Enjoys Its First National Convention

Winter Session at Atlanta Attended by Two Hundred Visitors

THE first national Independent telephone convention ever held south of the Mason and Dixon line brought some two hundred visitors to Atlanta, Ga., for a three-day stay beginning February 4, and incidentally served to unite more firmly than ever the bonds between the northern and the southern operating territories of the country's telephone system.

With President F. B. MacKinnon in the chair, the first session of the

Secretary-Treasurer W. S. Vivian.

convention was opened at the Piedmont Hotel with an invocation by Rev. Richard Orme Flinn, of Atlanta. The delegates were then welcomed to the city and the south by Judge Price Gilbert of the Georgia Supreme Court.

President MacKinnon responded, pointing out that service to the public has taken the place of the old competitive spirit, that the telephone operating business is really a profession, and that its employes should look upon it in that light. The public also, he said, must be made to appreciate the responsibility of service, an attitude still strange to many.

Chairman Murphy Candler of the Georgia Railroad Commission then addressed the meeting on the subject of regulation. While he believed the public was willing to pay equitable rates, he said, it is obviously the duty of regulating bodies to grant such rates regardless of mistaken public opposition.

President F. B. MacKinnon.

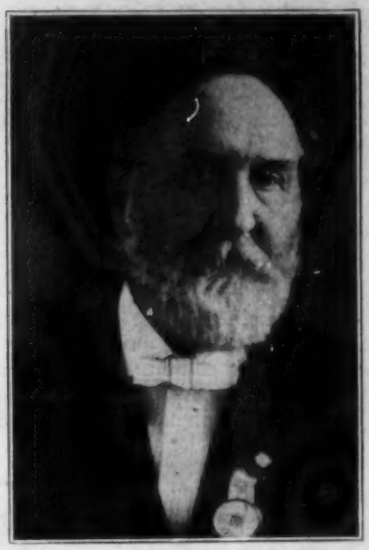
Association directors and other telephone men of prominence were then introduced by the chairman, and each said a few words. The question box was explained by B. Y. Cham-

Terry W. Allen,
Who Represented the South.

bers of the Consolidated Telephone Company, and adjournment followed.

THURSDAY MORNING, FEBRUARY 5.

Thursday morning, after the introduction of a number of other telephone men, the convention listened with interest to J. Prince Webster of Atlanta, formerly a rate expert employed by the state commission, on the subject of public relations. Diplomacy, open dealing, and the right kind of employes for direct public contact were the necessary elements prescribed by the speaker. Courtesy in dealing with complaints was emphasized. This address was thoroughly and interestedly discussed by a



E. B. Fisher,
Chairman of the Board.

number of visitors, who all agreed with the speaker as to the importance of proper methods in public relations.

Secretary-Treasurer W. S. Vivian, pressing a stereopticon into service, then delivered a sample lecture, designed for public explanation by E. C. Blomeyer, president of the Texas Telephone Company. The lantern slides were reproductions of charts showing the "reason behind rates." The whole address proved very popular, and the audience was much interested in President MacKinnon's announcement that the lecture and charts would be made available to members of the national or state associations.

After an informal discussion on depreciation, the meeting was addressed by Col. W. T. Gentry of the Southern Bell, who has served a total of fifty years in the telephone and

One of the Sessions of the Convention.

telegraph business. He gave it as his belief that one telephone operating company to a community gives the best service, but asserted that neither he nor other Bell executives wanted a monopoly of the business. Telephone service, he said, is better than any other service, and the subscriber gets more for his money than in anything else he buys. Because it is invisible, however, it is much misunderstood, reasons for delay in other service being generally apparent to the public.

"Wages of Labor" was the subject treated by W. G. Brorein, Tampa, Fla. He urged fairness toward the employes, with a wage sufficient for home comforts and pleasures. His company's employes were satisfied, he said, because they were given the same consideration as the stockholders.

FRIDAY MORNING, FEBRUARY 6.

Some reminiscences of 34 years in telephone operating were given as the opening number of the final session, by J. L. W. Zietlow, of Aberdeen, S. D. President J. A. Barnhardt of the Indiana Telephone Association, then spoke on the subject of newspaper publicity, explaining his company's method of preparing the public for a raise in rates, and the use of the new columns by the contribution of interesting facts to the newspaper men. Making the exchange attractive, and welcoming visitors to it, were other steps he advised. The people, he said, should be kept informed as to what the company was doing, and why.

Charles J. Metz of the Audit Company of the South, Atlanta, talked on system, emphasizing the relation of proper accounting to equitable rate making. He was followed by John W. Coffey, Indianapolis, of the Coffey System and Audit Company, who contributed further enlightenment on the same important subject.

The topic handled by R. E. Pattison Kline, Chicago, was "The Wages of Capital." This was a vigorous indictment of "red" theory, and a plea for the theory of private ownership marked by fair dealing and co-operation between employer and employe.

After a lively session with the question box, and discussions on the subjects of toll commissions, franchises, depreciation and a few engineering problems, the convention was declared adjourned.

On the afternoon of February 5, during the national convention, the Georgia Independent Telephone Association held its annual meeting, and elected the following officers:

President, R. L. Stewart, Thomasville; vice president, J. P. Manning, Fitzgerald; secretary-treasurer, J. R. Nunnally, Monroe; directors, the officers and J. M. Cook, Fort Valley; Ralph Smith, Fort Winder; Dr. L. G. Hardman, Thomas; G. H. Glass, Cuthbert; J. M. Dent, Douglas; S. D. McCutcheon, Dalton; W. D. Horton, McRae, and J. L. Mathews, Statesboro.

Operating Company Studies Health of Employees

Dr. Henry F. Vaughan, commissioner of the Board of Health of Detroit, has stated that the establishment of health and medical service for their employes by big employers of labor is a special influence for the general welfare. Dr. Vaughan has especially complimented the Michigan State Telephone Company health service, as a model among such establishments in the state. This company's medical department has proved a remarkable adjunct to the employment service. The work of the department is divided into four classes: Physical examination, care of accident cases, medical supervision of cases of illness and general work of a medical character pertaining to hygiene, good working conditions and so on.

Each applicant for work must un-

dergo a physical examination, one aim being to protect employes from possibility of contracting infectious and contagious diseases from workers added to the personnel of the organization. All physically unfit applicants are not rejected, scarcity of labor making this impracticable. However, no person is placed in a position that he cannot fill because of physical defect, and remedial defects are corrected.

Applicants are classified in three groups, the physically fit, those with correctible defects, and the physically unfit. Defects founded in those of the second class range from diseased roots of the teeth, diseased tonsils and visual defects, to the more major defects such as hernia.

Approximately 500 persons of this class enter the employ of the company each month. They are given specific directions for correction of defects and from the records of more than 10,000 examinations it has been shown that within 30 days, 48 per cent have followed the advice given, while at the end of five months 99 per cent have done so.

The telephone company employs approximately 8,000 persons in the state. Eventually its medical department will have a complete health record of every employe, while periodical examinations will be encouraged.

The department's services are largely advisory and given in co-operation with those of the family physician. Early and adequate attention in all cases of illness or indisposition is sought as the company feels this makes for a shorter period of disability, saving money both to itself and to the employes. Specialists are called when thought advisable. The offices of the department at Detroit are fitted with the most modern equipment. During the past year 750 individual cases were handled in the X-Ray rooms, in addition to which an average of ten X-Ray treatments were given each week. There is also a complete laboratory where chemical and bacteriological examinations are made. Cultures are made and promptly examined in all cases of possible diphtheretic sore throat. Blood analyses are made in a large number of cases where anaemia or allied conditions are suspected.

The telephone company uses the X-Ray in its fight on tuberculosis and has thus been able, often to detect this disease months before its presence might otherwise have been established. The company has at its disposal a number of sanatorium beds for use in tubercular cases and employes who are availing themselves of this arrangement are enthusiastic over the treatment given them and the progress made.

The Michigan State Telephone Company uses a staff of registered nurses throughout the state, each with a certain territory under her supervision. Periodically each district nurse visits the local exchanges and inquires into the health of the employes. Employes are encouraged to consult the district nurses and physicians. The company has retained for local employs the services of leading local physicians. So wide-spread has become the influence of the work, particularly in its educational aspects, that the company feels the benefits to the public are becoming general. The company believes its health work has resulted in improved telephone service given by well and contented men and women.

The telephone company also has in operation a sick, accident and death benefit plan that more than meets the requirements of the state compensation laws and means more to the employes and to the company itself than the mere dollars and cents involved.

The Michigan State Telephone Company proposes to continue improving and enlarging its medical department and extending the scope of its work, feeling that such service not only means more contented and more efficient employes but gains, for the company, many friends among the public. The company, furthermore, has expressed a willingness to aid other employers of labor in establishing such service for their workers and the members of its medical and nursing staff are equipped and willing to advise in matters of this sort. More and more employers are each year undertaking this work, recognizing it as a feature of great economic value.

Operators Reply to Subscribers' Criticisms

If there is any one individual in America who is getting more than her share of unfavorable publicity during this reconstruction period, it is the telephone operator, writes a Hamilton operator in response to a request offering them an opporuntiy to state their cases.

"When debates over the latest political shortcomings or mother-in-law jokes lag there is left the hello girl on whom to let forth disgruntlement, because she can no longer supply numbers as speedily and as bulkily as they demand them," she goes on eloquently. Attacks like these nettle her pride but do not prick her conscience. It is only when state board-of-health commissioners declare officially that poor telephone service is an actual menace to life; where a man of high blood pressure or weakened arteries in his anxiety to get a number suffers a hemorrhage, that central begins to get faint at the thought of the power she wields over human life.

Another girl, an operator for eight years, writes as follows: "The telephone girl is learning every day that the job is getting beyond her. The public she serves is the great rushing American public attuned to the whiz of the one minute lunch, dizzily descending elevator, and the rush of the subway and the elevated, a people that amasses fortunes in a night, and loses them in even shorter periods; the requirements of such a public have the operator to meet. And she is doing the best she can; better than is being done in any other country. She is as fast a machine as human power can wield, but, let us admit, she is not fast enough, for the American people expect miracles. The machine is bound to replace us in time.

"There was a time when switchboard work was the occupation of chumminess and leisure. Women customers would ask you for recipes for mustard plasters, and the chief operator used to sit at her desk embroidering initials on a pillow slip for her hope chest, and never even looked up when you came back from your 10 minute relief well satisfied with the Wednesday afternoon matinee. But today the chief operator of a big office is as easy to approach as the head of a big steel corporation, and the girl who is guilty of a one minute delay is given irksome penalties, to say the least. Though there are times when she cannot be immediately summoned by the flashing of your receiver hook, central is still at her prison-like post, perhaps listening patiently to the outburst of some irate subscriber."

"I am only an operator, pulling, plugging, reaching and jumping, eight hours out of every 24, trying to like you members of the public who are so antagonistic to me. Oh, sometimes I come upon a pleasing voice, and believe me it is balm to my tirade-worn soul ready to sink into oblivion after a day's combat with a babel of voices. It is the part of the job of a vigilant and cyclonic supervisor to pounce on an operator with her eternal report on those calls, here's a light, speed up. Don't worry at any of us loafing on the job. No chance.

"So when you hurl forth your cus-

tomary, 'Well central, did you wake up?' or 'Napping again?' remember that not for a second is the operator off the job; that every 10 feet apart there is watchful supervisor who travels her 10-foot beat to see that every light, flash and flicker is answered in record time; that over every supervisor is a still more watchful overseer to intensify the job of watching and that over the most vigilant human machine are other machines of still greater authority and infinitum.

"There are angel subscribers who are always satisfied with your service; there are subscribers who meet you halfway; and there are downright grouches who are never satisfied, no matter how hard you try to please them. Every office has them; every telephone girl is 'posted' on them. Central knows that if Mr. Grouch calls up she must drop her half-finished connection and minister to the man who gets $100 worth of service each month for $1. Failure to answer him within two moments means: You reported. An accidental cut-off-there is never a deliberate one as is commonly thought—has often meant to some hapless girl, in the old days, the loss of an $8 a week job."

"The root of all antagonism between public and operator is the subscriber's failure to realize that, besides himself, there are thousands as eager to get their 'parties' as he," one operator sums it up. "When signal lights appear on her switchboard as thick as a patch of stars, it is mortally impossible to answer every one at once, even with less busy operators on each side of her to help her out," she added.

Details of Michigan Merger Announced

That the Michigan State Telephone Company and the Citizens' Telephone Company are to divide their territory and that one company or the other will withdraw from territory in which both operate at present is made in a formal statement from the headquarters of the former company in Detroit.

The detailed statement says that improved and broadened telephone service will result in 47 cities and towns. Under the plans the Michigan State Telephone Company will give up to the Citizens' Telephone Company exchanges and service in 16 cities and towns while the latter company will turn over the service in 31 towns to the Michigan State.

Among the larger cities affected are Grand Rapids, Lansing, Jackson and Battle Creek. The Michigan State will take over from the Citizens' company service furnished by the latter to approximately 15,500 subscribers in territory where the Michigan State has about 22,300 patrons. The Citizens, on the other hand, will acquire about 13,800 of the present patrons of the Michigan State.

The Michigan State Telephone Company will continue to operate its long distance lines through the territory, the net result being that its subscribers going to the Citizens' will still have the advantage of connections to all parts of Michigan and of the country, while all new and remaining patrons will have similar benefits. Farmer users of the telephone will also benefit from such broadening of the service.

The completion of this deal will materially aid in doing away with the duplication of telephone service in Michigan. The communities affected have increasingly demanded elimination of the duplicated service which has compelled business men to pay for two telephones and has largely made it impossible for subscribers with but one service to hold wire communication with patrons of another company. Merchants and other telephone users, telephone men, and state, municipal and other governmental representatives understand therefore, and agree upon the desirability of the proposed change.

It has been recognized that no town is big enough to support two telephone companies adequately. Competition in the telephone business has usually worked to the detriment of the service because of insufficient supporting revenue. Such competition makes it necessary for both companies to cover the entire territory but with the list of subscribers divided, which often has made it impossible to install equipment sufficient to give the best service.

Through the arrangement now being worked out the Citizens' Company will take over exclusive operation in Grand Rapids and surrounding territory, going as far north as Baldwin and Reed City, east to include Ionia and Lake Odessa, south to take in Hastings and Allegan and west to Lake Michigan and will withdraw from other parts of the state.

The exchanges of the Michigan State Company to be acquired by the Citizens' include those at Allegan, Big Rapids, with 600 subscribers; Casnovia, Dorr, Grand Rapids, with 9,600 subscribers; Grand Haven, Greenville, Hastings, Holland, Hopkins, Iona, Lake Odessa, Newaygo, Sparta and White Cloud.

The Michigan State Telephone Company will take over from the Citizens' its exchanges at Athens, Baldwin, Bellevue, Cadillac, with 1,000 subscribers; Dimondale, Evart, Harrietta, Hersey, Kingsley, Leroy, Luther, McBain, Manton, Maple City, Mason, Nashville, Old Mission, Portland, Port Oneida, Potterville, Provemont, Leland, Reed City, Traverse City, with 1,600 subscribers; Tustin, Vermontville, Battle Creek, with 1,235 subscribers; Jackson with 2,570; Napoleon, Marshall and Lansing, with 5,000 subscribers.

The deal will be made as soon as the necessary approval of the public authorities is given.

The entire plan involves a division of the territory for the improvement of the service, similar to the deals under which duplication of service was eliminated in the city of Adrian and Lenawee county, Branch, St. Joseph county, Shiawassee, Clinton, Graitiot, Isabella and parts of Mecosta and Montcalm counties and in Pontiac, Detroit and Wayne county and surrounding towns.

Texas Oil Town Keeps Telephone Men Busy

Officials of the Cumberland Telephone and Telegraph Company are making plans to build a new exchange in Wichita Falls, Texas, to take care of the tremendous increase in wire traffic that has resulted from the oil boom.

The officers of the company made a survey of the city and conferred with the Chamber of Commerce officials. They expressed themselves as being convinced that it was time something was done to relieve the congestion.

The plans of the company include a new building on the rear of the present building at Ninth and Scott Streets and will be large enough to take care of future expansion. Work will be started some time during the early part of next year and rushed to a rapid completion.

After interviewing the officers of the city's banks and principal business houses, the telephone officials decided that Wichita Falls was not having a mush-room growth but was enjoying a real business growth.

The plans of the company include extension of country lines to all the small towns surrounding the city, at an early date.

Automatic Rural Telephone Lines

Abstracted from a Paper Read Before the American Institute of Electrical Engineers

By ARTHUR B. SMITH

TELEPHONE service on rural lines differs from that in cities and towns in that dwellings are much farther apart, there is usually no common center (except the nearest town) and greater dependence is placed on the telephone.

The requirements of the subscriber are low rental, dependability of service, and the ability to make many calls to those in his own neighborhood. On the other hand, the rural subscriber is usually willing to do more than his city brother. He will gladly push buttons, turn cranks, and do anything else if necessary to get service.

The operating company must have cheap but substantial lines, with as low an upkeep as possible, and a simple telephone requiring little maintenance.

Manual rural lines are usually operated with local battery transmission. Automatic rural party lines are also in use with local battery and with success. But a special weak current common battery transmitter has been developed which gives as good transmission on a 400 ohm loop as an ordinary transmitter does on zero loop. This has to a large extent made it possible to operate rural lines with common battery, with evident economies.

EQUIPMENT CHARACTERISTICS

The characteristics of the equipment which handles rural lines depend upon the telephone instruments, the method of operation which is desired, and the line conditions which are necessary in this class of business. Insulation can not be maintained at as high a figure as is possible in the city. Line resistance must greatly exceed the usual values. Many more telephones must be put on a single line than is necessary in town. These facts require changes in the apparatus.

Because of the number of bells and condensers (sometimes ten) bridged across the line and the lower insulation which is at times unavoidable, the control circuit and apparatus must have a greater factor of safety than is usual. To secure this a repeater is interposed between the rural line and the regular exchange apparatus.

This repeater has two line relays, Fig. 1, one in each battery lead. The impulsing is done with the relay which is connected to the positive grounded battery terminal. Also, during the time that impulses are coming in, the impedance of the negative line relay is greatly lowered. These two provisions greatly increase the reliability of the selection.

It frequently occurs that rural lines produce so much traffic that it overloads the group of first selectors belonging to the line-switch board (hundred line group). This is relieved either by subdividing the line switches into smaller groups, or by providing each rural line with its own first selector instead of a line switch; in this case the selector performs the functions of repeater as well as of selector. The relative cost of the two plans varies with conditions.

One condition incident to placing so many telephones upon one line is the chance of interference of one subscriber with the dialing of another. This is obviated by providing each telephone with a hook stop. It permits the hook to rise part way, only far enough to connect the receiver across the line (in series with a 2-microfarad condenser.) This allows the subscriber to listen without interfering with dialing which may be going on. If the line is free, the subscriber presses the hook stop; the lever then rises to the full extent of its stroke, connecting up the calling device and completing the talking circuit. Beside preventing interference with dialing, this device permits the rural subscriber to listen as much as he desires—a habit which is firmly established and warmly defended.

Fig. 1—Rural Line Controlling Circuit.

The signaling can be either selective or code ringing. The latter is very largely employed by manual exchanges, is understood by the subscribers, and seems to be satisfactory. Selective signaling is better in some respects, but the choice properly lies with those who are closely in touch with local conditions.

To ring ten bells selectively, five bells are bridged from each line wire to earth and rung with five frequencies. Two systems of frequencies are in use. The "multiple harmonic system" employes 16.7, 25, 33.3, 50 and 66.7 cycles per second. The "non-multiple harmonic system" uses the frequencies 20, 30, 42, 54, and 66 cycles per second. This duplication resulted from the historical development of two systems, and there are many installations of both in use today. It is to be hoped that one of the two may be retained as the better, and the manufacture of the other discontinued.

Code ringing permits all the bells to be alike and to be bridged across the line. In order not to interefere with dialing, the bells are mound to 3600 ohms (*approx. 5000* ohms impedance at 10 cycles per second) and the condensers limited to 0.3 microfarad capacitance. Signals may be made of combinations of long and short rings or of two groups of short rings separated by a pause.

Rural lines are served by a line-switch board set aside for this purpose. The special apparatus required is localized to this part of the equipment. If the signaling is selective, each connector has mounted on it a minor switch which picks out the frequency to be used. If code ringing is used, each connector has a code selector and a code switch. The latter groups the code signals, the former picks out the desired signal. The code switch is a single motion (rotary) switch with a 25-point bank. The code selector is the same in form and size as a first or second selector. They involve mechanisms which have been established by experience.

In general, reverting calls are handled by providing special switches leading to reverting call connectors. Each of these connectors is equipped much as a regular rural connector is equipped, but is wired so as to ring back on the originating line. If selective ringing is used, the reverting call connector will send out alternately the frequency of the originating station and of the called station. The total period of repetition is 4 or 5 seconds. To make a reverting call, the subscriber consults a list of the subscribers on his own line and dials the

number given for the desired station. He then hangs up his receiver. The alternate ringing begins and continues until the called subscriber removes his receiver from the hook and presses the hook-stop. The originating subscriber, noticing the cessation of his own signal, takes his own receiver, touches the hook-stop and proceeds to converse. Release is accomplished when both subscribers hang up their receivers. If the called station fails to respond, the originating subscriber stops the ringing by removing his receiver pressing the hook-stop, and hanging up the receiver again.

The line requirements for rural lines are as follows: maximum safe loop resistance 1000 ohms, minimum safe insulation resistance, wire to wire or either wire to earth 25,000 ohms. Any commercial telephone cable has low enough capacitance not to affect dialing.

Automatic switching offers to the rural subscriber a telephone service which is vastly superior to manual service and only slightly inferior to city automatic service. He has the same instantaneous, positive, direct calling at night as at noon, and on holidays as on work days. It is inferior to city automatic service only in the loading of the party line with so many telephones. In fact the moving force which hastened the application of automatic switching to rural lines was the pressure exerted by the farmers themselves to be given calling devices.

THE COMMUNITY EXCHANGE

The community exchange, as the term is now used, is a small unattended plant, whose toll switching and miscellaneous calls are handled from a distance and whose apparatus is often designed with the requirements of rural lines primarily in view. The community which it serves may be the farmers of a region, a small village or town, or the small suburb of a town. The traffic is chiefly local though by no means confined to the local telephones.

Miscellaneous services, such as information, complaint, dead numbers, etc., are usually cared for by the nearest public exchange where such service is maintained. Most of these community automatic exchanges are auxiliary to the ordinary type of public exchange. When the C. A. X. subscriber dials the information number, the call is trunked to the information clerk in that exchange, where records are kept for all the territory served.

Toll switching is handled in the same way as the above mentioned miscellaneous services. In fact it may pay to combine on one call number all these things, because one person can care for them all. The toll line operator is provided with a calling device and trunk connections to the community automatic exchange, so that she can complete and control any connection.

The subscribers requirements are the same as for any single office exchange with rural lines. From the standpoint of the operating company, the apparatus must require little attention and the investment must not be too large.

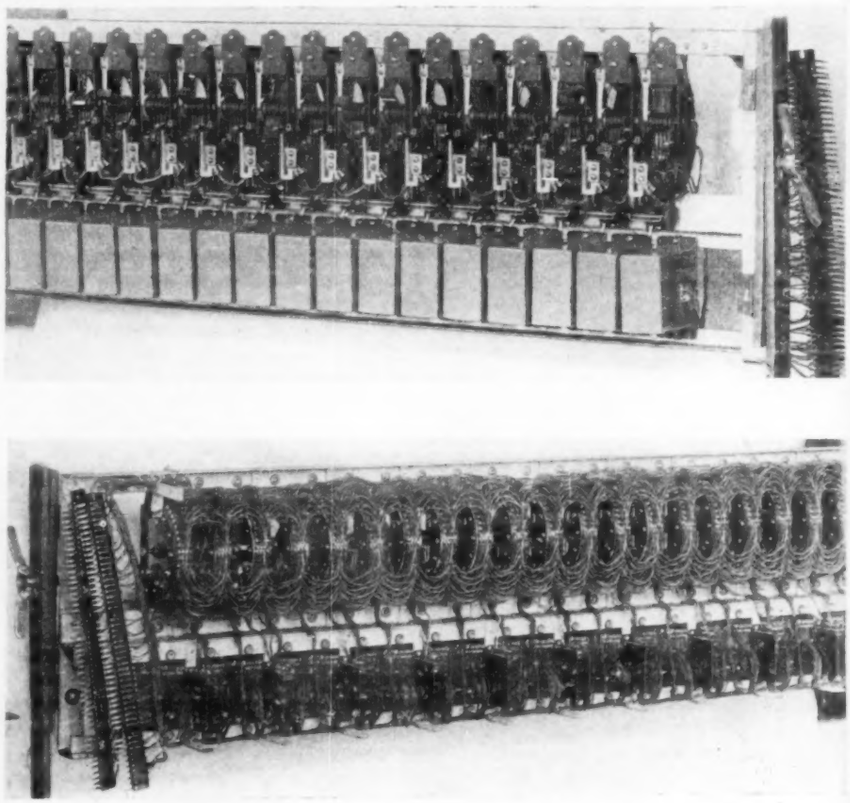


Fig. 2—Rotary Line Switches on Shelf. Top View, Front; Bottom View, Back.

The characteristics of the equipment are influenced by the condition of the particular installation. Too great rigidity of standardization would result in inefficiency. This will become apparent as we study the matter farther.

The rotary line switch Fig. 2, is the regular equipment for community automatic exchanges. It possesses simplicity of structure, individual control, minimum of motion, and greater trunk group than the plunger type.

The rotary line switch Fig. 3, is a single-motion switch, with a 25-trunk bank set vertically. The motor magnet armature has a pawl which normally locks the wipers on any trunk. The wipers rest where last used. When the magnet energizes, it withdraws the pawl so that it catches the next tooth on the ratchet wheel. When the magnet de-energizes, the armature spring drives the pawl and rotates the wipers to the next trunk contacts, and locks them there. The magnet is self vibrating, like a door bell.

Associated with the switch proper is a line relay and a cut off relay. They are mechanically interlocked so that if the line relay is de-energized, the cut off relay can pull up only part way—just enough to break contacts and clear the line of attachments. If the line relay is energized, the cut off relay can pull up all the way, connecting the subscriber's line to the wipers.

When a call comes through a connector to the subscriber, the connector energizes the cut off relay alone. This clears the line of line relay and ground, but does not connect the line to the wipers. Thus there is a clear pair of wires from the connector to the subscriber's telephone.

When the subscriber originates a

call, by lifting the receiver from the hook, the line relay pulls up and causes the trunk to be tested. If the trunk is busy, the magnet rotates the wipers at a speed of 60 to 80 trunks per second until an idle trunk is found. The magnet then stops, the cut off relay pulls up, clears the line, and extends the line to the first selector. During conversation, the cut off relay alone is energized. On release the cut off relay merely falls back—the wipers remain where they are. If the trunk upon which the wipers were resting at first is idle, the cut off relay pulls up completely and without delay. The time required to seize the trunk is only that required for two relays to energize. The maximum time required, if the wipers must pass over 24 trunks, is about half a second.

Most calls take an idle trunk without moving the line switch wipers at all. Tests made on a busy private automatic exchange showed that about 16 per cent to 20 per cent of the calls moved the wipers one or more steps—the rest of the calls required no motion.

Because it possesses no common mechanism, the rotary line switch lends itself admirably to rural exchanges. There is so little to get out of order, and the factor of safety is so large, that it can be relied upon to require very little attention. And if any one part *should* fail, it affects only one subscriber line instead of a group of lines.

The most important variable factors are herewith presented and will be discussed in detail.

1. Transmission .....
   ....Local battery or common battery
2. Line relay .....
   .....Double wound or ground relay
3. Line equipment.....
   .....Lineswitch or selector
4. Signalling.....Selective or code
5. Signal Control.....
   .....Push-button or periodic
6. Reverting calls.....
   Push-button, periodic or hand generator
7. Battery charging means.....
   Motor generator or gasoline engine
8. Battery charging method.....
   Float or hand start with automatic stop

The tendency is to use common battery transmission as far as possible. The replacement of dry cells is a great and increasing expense. It is to be incurred only if the salvage of present equipment causes it to seem more profitable to retain the local battery, or if the lines are so long that it is necessary for good transmission. As far as automatic operation is concerned, it makes no difference which is used. Most lines are long enough to require a special weak current common battery transmitter. In all cases the polarized receiver is necessary, because the subscriber must be able to listen through a condenser to see if the line is in use.

The line relay (*LR*, Fig. 1) which handles the impulses should be connected to the positive or grounded battery terminal. Here it has a greater factor of safety than if it has two windings, one being to each battery terminal. If the line conditions are as good as in town, the usual double-wound line relay is fully adequate.

The usual practice is to carry all lines in a community automatic exchange to line switches. All selectors and connectors are usually equipped with the ground line relay circuit, so as to render repeaters unnecessary.

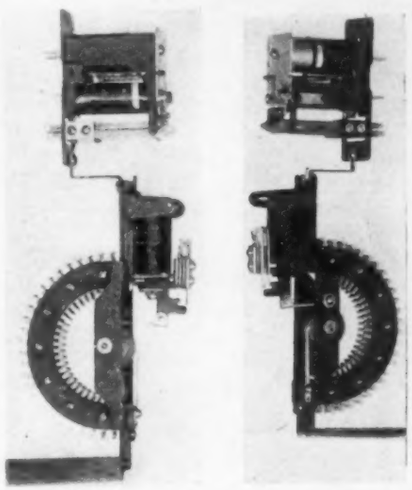


Fig. 3—Rotary Line Switch, Right and Left Views.

In region where rural subscribers have been using local battery magneto telephones for years and are accustomed to code signals, the code signal can still be used with automatic. The non-secret nature of the call is by some regarded as a positive advantage. It is difficult for the city-dweller to realize how the farmer uses his telephone. An instance will illustrate one point. One evening Jones repeatedly heard his bell give the signal for the Browns, who live a quarter of a mile down the road. Knowing that the whole Brown family had gone to town for the evening, he stepped to the telephone, and gave the calling subscriber the information. More congested rural regions seem to require greater secrecy, and the selective signal is favored and sometimes even requested.

The signal may be controlled by the subscriber or by the central office apparatus. The former is called "push-button control" or "push-button ringing." If it be code signaling, the subscriber presses a button on his telephone so as to form the signals. They may be thus made more accurately and easily than by the hand generator, with its revolving armature which must be started and stopped several times in each signal.

To secure push-button ringing, the button is arranged to ground the negative line and open the positive line. The negative line relay remains energized and prevents the connection from releasing. The positive line relay controls the ringing apparatus.

Reverting calls are handled in accordance with the method of signaling used. If local battery magneto telephones are employed, the subscribers ring each other on the same line just as they did with the manual switchboard. If selective signaling is employed, the subscriber dials a special number and receives alternate signals as was described above. If code signaling is used it may be either periodic or push-button controlled. The latter requires reverting selectors, available to the party lines.

When a rural subscriber desires to call a person on his own line, he dials a special number. He then presses his push-button to form the code signal. This action controls a relay in the reverting selector, which sends ringing current back onto the originating line.

If the code ringing is periodic, reverting calls are handled by reverting connectors which are equipped very much like the regular connectors. The subscriber consults a list of subscribers on his own line (posted on the telephone.) He then dials the special number given for the desired station and hangs up his receiver. The desired code signal is sent back on the line, repeated periodically. When the called stations answer, the ringing is cut off—the originating subscriber then comes in on the line. Both subscribers hanging up release the reverting apparatus.

The charging of the battery is done preferably by a motor generator run by commercial power. The battery bus bars are equipped with a voltage relay, which starts the motor generator whenever the pressure falls to 46 volts and stops it when it reaches 52 volts. A self-closing reverse cur-

rent circuit breaker stands between the generator and the battery. When the generator voltage is high enough to be safe, the circuit breaker closes and the changing begins. When the motor has been cut off by the high voltage, the generator voltage dies away until a slight reverse current operates the circuit breaker and cuts off the circuit.

If no commercial power is available, a gasoline unit is installed. This is started by hand as often as necessary. The regular maintainer need not do it, some one who lives near the exchange and is familiar with gasoline engines is employed to set it to going. The stopping is automatic. An ampere-hour meter is included in the battery circuit. It is compensated so as to run slowly when charging, but full speed when discharging. When the meter indicates the necessary ampere-hours have been put into the battery, it opens the ignition circuit of the engine, so that the latter stops. The circuit breaker disconnects the generator from the battery. During the time of charge, the circuit breaker inserts counter e.m.f. cells in the discharge lead to the power board—they prevent undue rise of voltage on the bus bars which would prematurely stop the charging.

The equipment is made up in three general units, the switch board, the storage battery and the charging machine. The switchboard is made in two or three parts, which are installed side by side so as to form one unit. These parts are the local switchboard, the powerboard and the main distributing frame, and the trunking board. The latter is omitted if the exchange is isolated (no trunks to other exchanges.) All but the trunking board have been fairly well standardized. Because of the many variable conditions to be met in different places the trunk board, containing selectors and repeaters, is made up in accordance with the needs.

A community automatic exchange needs no special building to house it. It has been installed in a store, in the bedroom of a residence—any convenient place which is available. There are signals to indicate when a fuse blows, etc. The conditions of community life and the location of the apparatus are such that someone is always not far away.

This type of exchange has not been in service long enough to secure data of general worth as to the amount of maintenance labor required. In one case a group of three of these exchanges located on a straight line 26½ miles long, together with the telephones belonging to them are maintained by one man. The man is of the same general type as those who maintain ordinary automatic equipment.

Building Fine New Exchange in Peoria

Work is now being rushed in a number of great factories on the Peoria, Ill., central office equipment of the Central Union Telephone Company and next December the entire outfit will be ready for delivery.

This machinery will cost $750,000. The new building in which this equipment will be housed is to be completed in time to receive it, and will cost $250,000. The amount estimated for outside plant equipment which is calculated to take care of the growth in business up to 1935 is $400,000.

Just now double cable is having to be laid in preparation for the moving of the telephone "central" next winter. This will be so arranged that when the time comes, the young women will walk from one building to the other and work will begin in the new central office so easily that the subscriber will never know when the change was made.

The new exchange building in Peoria, on which work will be resumed so soon as the weather seems to permit of the pouring of concrete, will be so built as to take care of the needs of a growing city for many years to come.

When asked how long the telephone service must be interrupted by the move from the old building into the new, District Manager G. C. Treadway said: "We hope it will take the same length of time as did the change of the subscribers of the Inter-State system to ours, which was less than a minute."

Then he explained how the telephones were "cut over" into the new system at midnight on the thirtieth of November and nobody knew what had happened.

This is the plan that will be used in the big "cut over." By the use of the double cable system the old equipment will be used up to the minute the new switchboards are ready to receive the business and then, in the twinkling of an eye, thousands of miles of cable and equipment will be junked and may be removed at pleasure.

Work on the scrapping of the useless property of the old system is now going on. Miles of line and hundreds of poles must come down. But this work in no way interferes with the service, for the work was all painlessly turned in the new direction on Nov. 30.

Experts who have visited Peoria and looked over the plans for the new building and equipment, say that Peoria will have the most up-to-date plant of its kind in the United States.

The plan in such a construction as this is really to set up all the machinery and then build the walls and roof around that machinery. The place throughout has been planned for the one service. The house will be four stories with the roof such that, when necessary, it can be the floor of the fifth story. The building will be of steel and concrete with every modern device inside to make it a perfect workshop.

The lighting will be X-ray cove system, with no fixtures visible. An air conditioning apparatus will control humidity and heat. Rest rooms and a cafeteria will care for the physical wants of employes.

Grand Jury Takes Slap at Local Service

A grand jury at Bowling Green, Ky., returned indictments against both the Cumberland Telephone Company and the Bowling Green Home Telephone Company, charging them with maintaining a nuisance.

One true bill was returned against each of the companies and were drawn on the grounds of the health of the public as well as safety of property of the public is endangered by reason of the companies failing to render service required of them employing unskilled employes, failure to get proper fire service answering calls by partons when illness prevails in homes, negligence in answering calls, etc.

Bell Stock Issue O. K'd by Court

A suit to restrain the American Telephone and Telegraph Company from issuing $50,000,000 in convertible stock, filed by Clarence H. Venner, as a stockholder, was dismissed by Supreme Court Justice Erlanger. Venner contended that the issue would be illegal on the ground that it would increase the stock issue of the company beyond the charter limit.

Justice Erlanger pointed out that the company now has outstanding stock amounting to $500,000,000, although it was organized in 1885 with a stock issue of $100,000.

The Wire is Busy—and Why

Some People Call Them Telephone Hogs*

By HELEN B. LOWRY

WHY, the very idea!" ejaculated the lady well along in the nineteenth minute of her telephone conversation, "asking folks not to talk like we don't pay for service; that we don't get either I'm here to say. They act like it's my fault about flu spreading about, and goodness knows I don't expose myself. Why, I haven't let Oscar kiss me for a whole week, and I never did let Trixie be spoken to by strangers—

"What's that, dearie! The telephone company says cut out unnecessary calls until after the epidemic's over? Oh, that's different! I'm perfectly positive that there're a lot of unnecessary calls, my dear, because often it takes me fifteen minutes to get a number, telling you the line's busy and all that sort of thing. Now, all my calls are absolutely necessary. No, no, dearie, of course I didn't see it in the paper. When do I get time to read the paper except the want ads? Aren't they a scream? I just love to read the want ads, don't you?

"What was I saying?—Oh, yes, I was telling you about that dress I'm thinking about getting this afternoon. What do you think about navy blue tricolette? Don't you think navy blue is flattering to the figure? Yes, with cream net collars and cuffs. Do you remember that blue crepe de chine I had last year with the cream vest?—Well—"

I handed the receiver back to the blonde operator of the upper Broadway apartment house. For a "consideration" I had been allowed to "listen in." The blonde operator straightened the metal band upon her perpetual wave, and adjusted the powder on her nose.

"Say, didn't I tell you? These here telephone hounds, they don't talk about nothing interesting enough to listen in on. Say, I stopped doing that the first month I was in this house, though it weren't so slow I'm telling you, when I was in the Forty-fifth Street Wests. Now that fifth floor G, every morning, don't she call up them self-same numbers, and then them old girls tells each other what clothes they're going to get, and what clothes they got, and what shows they went to yesterday, and what matinee let's go to today.

"And symptoms—Lord, the number of symptoms goes over this wire every day would stock a hospital. They tell each other if they get a sore finger. Say, I'm here for one to say that if there's anything goes on interesting over this switchboard, I ain't heard it. And stop 'um by telling 'um there's flu? Say, Gabriel's trumpet wouldn't stop 'um once they get started on telling each other what the heroine did in the movies last night."

That is the consensus of the switchboard operators up and down the apartment house neighborhoods and family hotels of New York.

"Folks in hotels get so blamed selfish," explains the operator of a fashionable apartment hotel, "that you could tell them there's a death in the house and you're trying to get the undertaker (which naturally no proper-run hotel exposes) and they'd keep right on with their talk about matinees. Last year I knowed how it worked out when the flu was on. All the folks that had necessary calls cut down on them. And these telephone hounds, they kept right on talking all morning long. Say, the only thing that stops them is to get it themselves. Naturally that helps out considerable, what with my partner down and sick, and you sitting in her very chair, which the management assures me ain't catching, so don't be nervous."

It is the same in the Murray Hill boarding houses, where women are as idle, if not so moneyed, as those who dwell in the hotels of the Seventies. My informant in this case is of the colored persuasion, and her life has been spent in the brownstone regions of those who board from the Thirties to the Nineties. The board wisdom of the ages gleams in her eyes, as she reveals to me the only skeleton in the narrow boarding house closet that O. Henry overlooked.

"In a closet?" says Linda, puzzled. "No, ma'am, they don't attend to their calls in no closet. We don't have no booth. Jes' the regular hall and connections on every flo'. Yessum, I'se worked in boarding houses now for 'bout twenty years, preferring them because of company, and I ain't never yet found one where there weren't one of them telephoning ladies. Yessum, it's in the morning they mostly telephones, before they puts on all their clo's, between breakfast, which is 35 cents extra now if served in room, the elevator being broke, and dressing again to go out. 'Pears like they can talk so much freer and easier in a kimono and nothing lacing them up tight.

"Yessum, it takes considerable strength to stand at the telephone in them half hour spells. You try it some day and see. Well, no'm, I don't guess you can if you works. Course, ladies that works don't get no time to fool away on telephones. I don't even have no time to listen in. Yessum, I tries sometimes, and it don't pay you for the trouble, cause they's always saying the same thing, no matter what boarding house I'se working in, nor what year it is. You know—all about new clo's and the show, and about how tired they gits about what they has to eat, and there ain't no variety in desserts."

Ah, well! As the boarding houses become apartment hotels, the telephone registers much "unnecessary conversation" on the growing price of things; the telephoners become younger. "Most intimate friends" tell each other the story of their lives from 10 to 11, and from 12 to 2 lovers hold down the wire for eons of time per call.

"And don't you think the flu's going to stop them," scornfully smiles the high priestess of the switchboard, which has just contributed lovers to my repertoire of telephone hogs. "I can't even budge them by charging them up every five minutes. Believe me, it wouldn't make any hit on me for a fellow to waste his money telephoning me for half an hour. Say, with my training, I guess he'd have to figure out some other way to blow his coin."

But these are all "middle class" telephone habitues, whom I have thus far rounded up. I long to hear what "cultured persons" say to each other, when a hostess is called from her guests (and I am one of them) for a nice long chat about the musical benefit they're getting up together. I yearn to know what the harried business man replies when the sweet young thing calls him up to announce "Guess who this is." And, above all,

*The *New York Times Magazine*.

I want to know the "unnecessary conversations" of my lady of real fashion. How is it with her when she takes her period "interior decorationed" telephone in hand? And will she take it in hand not quite so often until that much advertised peak of the epidemic shall have passed?

Here, I am met by an impenetrable barrier. Her telephone connects with no vulgar switchboard, nor need she stand in any exposed boarding house hall—like her sister under the skin, whose only secret vice can be the electric iron. As for the reports of the public operators, poor dears, their tongues are hanging out, telling you that the line you want is busy. So what time do they have to "listen in"? "And couldn't if we got a chance," explains one black-eyed little minx who has gone into the hotel line, quite frankly, because they are not all like the Martha Washington. "There's always some old cat of an inspector around to fire you if you get caught listening in."

And so perforce I turn to her, on whom I have learned to depend for beauty and for most inside information of the "elity" to Madame la Masseuse.

"Mon dieu, Mees, you think they will stop now there ees one more so fascinating thing to talk about and that ees the flu! It ees worse than ever. Never were the symptoms of such great interest. Four times, Mees, four times while I do one face do the telephone interrupt her, and always she say the same.

"'Do you have any symptoms? I have just talk with Margot, and she have pain in the back. Mabel, she have it—yes I talk with Anne that have call up everybody to find out who have it. Now, dear, let me give you some advice. Gargle every hour and wash your hand the dozen times the day. Oh, you mean that you have never gargle? My dear, I will give you my prescription from the most wonderful doctor—so patient, so distingúe. I think you should call him if you have the slightest symptom.'

"Yes, yes, every place I go they are afraid of symptoms, that they almost forget to talk of gossip and the party the yesterday evening and the bridge the afternoon and who is admired by who and all those important happenings."

And so it goes the city through. So, perhaps, it would be just as well if the telephone company would furnish a diagram of just what an "unnecessary conversation" really is. For, by the present system of self-determination of telephone fans the problem shows "symptoms" of being solved in just one apartment house that I visited. This independent little New Jersey of a house is in the Columbia University neighborhood—where salaries are what any of these Four Million Dollar College Drives will inform you.

The competent black operator looks out of her cubby hole with a grin. "Honey, it takes me jes one charge for overtime to fix these here ladies. Jes one little extra nickel and these here eye-glassed tight wads is learned for life."

Doctor Says Bad Service May Cause Hemorrhage

Telephone service in the United States has become so poor that it is actually a menace to public health and morals, according to a report prepared by Health Commissioner Copeland of New York.

Dr. Copeland declared that in the last few weeks twenty-five inspectors had found not only many violations of important health regulations, but that the usual delay a patron experiences in getting a number through Central arouses one's indignation to such an extent that it might bring on a cerebral hemorrhage.

The health commissioner has recommended an even closer scrutiny of these conditions "for the sake of public health," and continues:

"The condition of the telephone service has been such for the past several months that in my opinion it has become a serious menace to the public health. It is all very well to talk about restraining one's anger, keeping calm under all circumstances, and all that sort of thing; but the fact remains that where it is necessary to wait from five to twenty minutes to get Central the average citizen will suffer from righteous indignation, if not from unrighteous wrath.

"If it happens that a man trying to get Central has high blood pressure or weakened arteries, he is liable to break a blood vessel and suffer from cerebral hemorrhage.

"Furthermore, there are in use in this city hundreds of public telephone booths. If a person infected with influenza, contagious skin disease or any other infectious or contagious disorder should go into one of these booths and remain there from five to ten minutes, waiting to get his number, it does not require any stretch of imagination to believe that the contamination of this public booth will be such as to render it a menace to the next person who makes use of that particular telephone."

Hartford to Have New Automatic Exchange

For the most part the plant additions to the Southern New England Telephone Company, during 1920, will be central office equipment, subscribers' equipment, outside cables, poles, wires, etc., of the usual character. A notable exception will be the installation of a 5,000 line unit of machine switching or so-called automatic service equipment in Hartford. The number of girl workers in that city is far below the needs of industry and the disproportion is rapidly increasing. "It is reflected in our own business," says the annual report, "to the extent that we have already found it necessary to supplement our local Hartford force with operators temporarily transferred from other exchanges, the company leasing and operating a large dwelling to accomplish the living arrangements for this constantly growing number of out of town girls. While the automatic is by no means the "girlless" telephone that it is popularly supposed to be, it does greatly reduce the operating force requirements and its development has reached the point of full adaptability to the service needs of our Hartford exchange. By utilizing the initial installation for the high traffic lines, we shall alleviate much of the present difficulty in rendering service in Hartford, and relief will be more and more pronounced as similar equipment is added from time to time. We have no doubt that the automatic service will be received with favor by our subscribers and we are indeed fortunate in being able to obtain the equipment under present conditions of supply and demand.

"To house the automatic equipment and to provide space for other needs occasioned by the growth of the business in Hartford we have already commenced the construction of a seven-story extension of our present Pearl street building through to Hicks street. We expect that this addition will be completed by the time the automatic equipment is received and that the new service will be in operation during the latter part of the year."

Influence of Invention in the Bell System

An Address Before the Telephone Society of the New England Telephone Company

By T. D. LOCKWOOD

SCARCELY more than a century has elapsed since a new power has, by the genius of discoverers and the talents of inventors, been trained to the service of mankind. This power is electricity.

It is, I believe, beyond question that the highest achievement in the electrical transmission of intelligence is the speaking telephone. This comes home to us, for we all use it, and any *can* use it. It both talks and hears; and accomplishes the function of both ear and vocal organs by a mechanism actually simpler than that with which the human being is endowed for like purposes.

FIRST PATENT GRANTED IN 1876

On the Fourth of July in the Centennial year, 1876, there was not a single telephone in commercial use anywhere, but now where are they not? The telephone was patented in March, 1876, and is, therefore, little more than forty years old; yet it has utterly transformed methods of transacting business.

By the annual report of the American Telephone and Telegraph Company we find that in 1918 the number of exchange connections for Bell telephone alone was about 10,750,000,000, or a daily number of over 32,000,000.

It is not necessary on this occasion that much shall be said regarding the telephone itself, and for our present purposes, after premising that the invention of the carbon microphone transmitter was itself an important improvement, and that for special purposes many refinements in detail have been introduced, it may be assumed that we are discussing a time when the telephone had already become an accomplished fact, and that our problems thus turn upon the question of how best to make it available.

THIRTY-SIX HUNDRED TELEPHONE PATENTS GRANTED

Experience has proved that every radically new, or really pioneer, invention is invariably the forerunner and promotive impulse of a multitude of improvements and subsidiary inventions. The telephone has not been an exception to this experience. As previously remarked, it is but little more than forty years since it was invented, yet within that period of time, or down to December 31, 1918, there have been granted 2680 United States patents for inventions in telephones (comprising transmitters, receivers, and amplifiers, etc.), and 11,384 more for switchboards, cables, signal apparatus, protectors, and other telephonic appliances; a total of 14,028 patented inventions, all directly traceable to the original and parent invention.

Any consideration of the immense mass of invention required to bring the Bell System to its present status and to continue improvement to still higher standards in the future, will be facilitated by thinking of it as being divisible into four classes, viz.—inventions applicable to users' stations, to the central station, to the line and to the telephone circuit as a whole. Or, adopting the functional point of view, it is sometimes convenient to regard telephone inventions as being severely concerned with the operations of signaling, switching, and talking. But, howsoever we attempt to classify, we have always to keep in mind that there is no hard-and-fast dividing line between the classes; and that many important inventions partake of the characteristics of more than one of these classes.

THE STORY OF THE FIRST TELEPHONE

The earliest and simplest telephone organization is, of course, a private line uniting two stations. It is evident that even so simple an arrangement as this requires some kind of a call signal, and that if the two stations are to have equal facilities, each must have some means to send and also some means to receive a call. A telegraph key and sounder were at first used, in connection with a battery included in the circuit. This was not an invention, but an obvious expedient. A magneto machine, which by the same operation both generated and transmitted the call current, was, however, soon substituted; and since the current so generated was alternating, the use of a polarized bell as a call receiving instrument suggested itself immediately.

Invention was at this stage much in request; and in prompt response there came into being the centrally pivoted armature polarized bell (the ringer, as it is often termed), which was so perfectly satisfactory in result that, unchanged except in minor details, it was continued until the present time, and is still universally employed.

SOME EARLY HISTORY

To make the magneto call apparatus complete, two other features were required; i. e., the suspension switch to transfer the line connection between the telephone and bell (these being in separate branches), without any requirement of deliberate action by the user; and a contrivance responsive to the operation of the generator in sending the call, to bring the generator armature coil into circuit, and to disconnect or withdraw it after the signal had been transmitted, or when the generator was no longer in operation. A number of different forms or arrangements of both of these features were devised by several inventors.

The reason for the first was that, in the early days of the telephone, a hand switch was provided, which turned to one position to connect the telephone with the line during talking, and to a second position to connect the line with the call bell at other times. But the user, having so turned his switch as to connect his telephone when he received a call, usually forgot to turn it back when he had finised talking; and it thus came about that the next time some one wished to speak with him his bell was not connected and he could not be called.

The receiving telephone, however, had to have some regular place when not being used; and it was a happy thought to provide a hook, or similar support for it, which could be moved one way by its weight when placed thereon, and reversely by means of a spring when the receiver was taken up for use. Being thus movable, the hook was made to serve as the switch lever; and the user was thus enabled to automatically turn his switch in the proper direction without any action on his own part being required, except to take the instrument from its hook support when it was wanted for conversation, and to put it back to its obvious place when the talk was finished.

PLANT TROUBLES OF YEARS AGO

The second of these initial inventions came about in an equally natural

way. The impedance of the generator coil, at intermediate stations, was detrimental to both the loudness and clearness of the telephone talk; and at terminal stations diminished the sharpness of the bell call, and also was itself much subject to injury from lightning discharges.

To obviate these disadvantages a short circuit round the coil was provided, originally arranged to be broken by a push-button during the operation of the generator. It soon, however, occurred to several inventive minds that this circuit-breaker could readily be actuated by the revolving motion of the generator shaft when the crank was turned to send a call; and thus was accomplished another step towards a complete and satisfactory bell and generator apparatus.

Finally, and after the lapse of years, the improvement known as the bridging bell was developed. This was devised to meet the requirement of a magneto bell, efficiently workable on lines of many stations, and involved several features of true invention.

The magnets were made with long cores and wound with many convolutions, so that when connected across between the two line conductors the voice currents would not be shunted through them and away from the telephones. The generator was of fewer turns and was so connected between the terminal screws as to be also in bridge, and in parallel to the bell magnet. Its bridge was, however, normally open and arranged to be closed while sending a call. The telephone branch, also open when at rest, was connected as a third parallel bridge, controlled by the suspension switch.

This bell apparatus, while designed for polystation circuits, proved, however, to be a superior station apparatus, even on lines having but one user's station, and practically superseded all previous arrangements.

THE FIRST TELEPHONE EXCHANGE

Within two years from the time that the telephone appeared its principal role was more than communication—that it was intercommunication. And early in 1878 the telephone exchange came into existence. The public mind now does not discriminate between the telephone and the telephone exchange, or, in other words, it thinks—if it thinks at all—that the exchange service *is* the telephone. It is fair to say that, while the telephone has made the exchange possible, the exchange has made the telephone indispensable.

This consideration at once brings the central station into the foreground and the heart and essence of the central station is the switchboard.

Without the exchange system switchboard, telephone communication would very quickly, by its immensity, become prohibitive. For, in that case, there would, to carry on a like business, be required a line from each station to every other station. If there are but two stations, one line only is required, which does not look very formidable; but the appetite of such a non-organization grows very fast. Three stations would require three lines, and groups of four, five and six stations would respectively require six, ten and fifteen lines, and so on. As a matter of curiosity, I once carried the calculation out to some extent, and found that:

For 100 stations the number of lines required would be 4,950; for 500 stations, 124,750 lines; for 1,000 stations 499,500 lines; and for 5,000 stations, 12,497,500 lines.

Of course the very idea of such an arrangement is absolutely ridiculous, and no one but a lunatic could think seriously of it; but it is worthy of mention, if for nothing else than to emphasize the wonderful utility of the switchboard.

An amazing amount of invention has, and an equally amazing number of inventions, the importance and influence of which it is impossible to overestimate, have related to switchboard work, and are combined in the highly organized and complete switchboard apparatus of the present time.

Switchboards were not new with the telephone. They have been with us since the inception of the telegraph. But the telegraph and telephone switchboards are two entirely different affairs. The former was a convenient means for uniting any incoming line with any desired instrument, or, once in awhile, for connecting two lines for through communication, and required an expert for its manipulation. The latter was designed absolutely for the expeditious establishment of interconnection of any two of a large number of lines, with the ready accomplishment of the several sub-operations involved. The Western Electric Company, in process of time, developed the multiple switchboard.

The multiple switchboard is surely one of the most remarkable advances that have been made in technical telephony; and in many successive forms has maintained its prominent position, from the year 1879, when it first appeared, until the present time; having survived many changes of system, some of which—for instance, that which introduced central energy methods—were of revolutionary character.

When this instrumentality first appeared, it was termed the *"Duplicate Board,"* since it was not supposed that more than two sections of duplicate spring jacks would ever be required. Moreover, the answering of calls and disconnection orders, and the actual switching work were done by different sets of operators, at distinct and differently placed apparatus.

One very noticeable feature of the multiple switchboard is that it was and is, and will remain, a conglomeration of a great many inventions.

Its division into a large number of sections, each having facilities for answering and supervising a definite number of lines, and also for establishing connection between such lines and all lines entering the station, makes it evident that provision must be made at each section by means of which the operator there can determine before establishing communication with a wanted line whether or not such line is already switched for use at some other section. This, of course, is what we know as the "busy test."

THE OPERATOR OF THE FIRST MULTIPLE SWITCHBOARD

In the earliest installations of the multiple switchboard, it wasn't a test at all, but merely a visible indication. There was at each section a board with the numbers of all of the lines imprinted on it, placed where it could be seen by all operators, and an operator having switched together any two lines would then hang up a brass disk over each of the two numbers concerned. The other operators were supposed to look at the sign board so decorated, and refrain from connecting with any line thus proclaimed to be busy.

I have referred to the numerous inventions that are combined in the multiple switchboard. About fifteen hundred United States patents have been granted for improvements in such switchboards or important parts thereof, and in apparatus relating to it; and, of these, probably about five hundred are for the varieties of busy test systems. It is this conglomerate apparatus which, more than any other instrumentality, has made telephone exchange communication on a large scale possible and practical, and, while doing this, it has at the same time operated to improve, cheapen, and quicken the service.

It has been estimated that by employing the multiple switchboard, a saving of ten seconds for each operation of bringing two substations into communication is well within the facts. This may at first thought be regraded as an insignificant economy, but when we take into account that it is to be multiplied by the number of switch connections effected every day throughout the year, it is insignificant no longer.

AN INTERESTING STUDY BY MR. LOCKWOOD

A calculation I made some years ago and revised at the close of the year 1916, based upon the daily and yearly number of completed exchange connections made in the Bell system that year, and assuming that one-half of the total number were made by means of multiple switchboards, shows that the time saved, for the people of the United States who use the Bell telephone, in a single year, by the availability of the multiple board, reaches the stupendous amount of 511,000 days, or 1,400 years.

To save fourteen centuries in one year is truly an Herculean achievement.

The devising and adaptation of power-driven call generators, and special exchange apparatus, as distributing frames, monitors' sets, and like appliances, are all in this class, and have each contributed largely to the gross amount and far-reaching importance of telephonic invention.

THE INTRODUCTION OF COPPER LIME WIRE

Passing to practical improvements, which more particularly concern the line, it is easily recalled that these include the introduction of copper line wire, the metallic circuit, underground construction generally, the transposition of conductors in loose order, and the modern many conductor cable. Not all of these in themselves involve invention, but each improvement has invariably suggested and carried in its train a multitude of additions and further improvements, many of them real inventions, without which its full benefit could not have been realized. Thus, copper line wire came into use with the first experimental long distance line—that built in 1884 between Boston and New York—and immediately made necessary a new kind of splice or joint and new modes of attachment.

The inductively neutral metallic circuit, though employed in France in the earliest telephone line construction, did not come into extensive use in the United States for exchange work until about the year 1888. The long distance lines had, however, prepared the way for it, by arranging special loops for their terminals. The first exchange switchboard wired on a large scale for metallic circuits was one of 10,000 line capacity, installed at No. 18 Courtland street, New York. This was originally wired for grounded circuits, but before it went into use, decision was made that the time had arrived for the adoption generally of the metallic circuit principle; and the board had to be re-wired accordingly. But this made a good beginning for the use in the Bell System of the metallic circuit in exechange construction, a use which has become universal.

THE GRADUAL USE OF UNDERGROUND

Underground construction came into being gradually, and experience was gained through many mistakes in system, conduit material, insulation, and modes of installing wires. But the terracotta tile and the "drawing-in" mode of placing cables steadily grew in favor and have become standard. In this department of work, invention has concerned chiefly the construction and arrangement of manholes, the manner of entering buildings, and the appliances for drawing cables into and out of ducts.

Even before the modern highly improved cable was perfected, the cable conductors were arranged in twisted pairs. But when long metallic circuits were in the form of pole lines, the application of the twist principle was a problem. But it was solved by causing the two conductors of each circuit to exchange places on the pole crossarms, at suitable intervals, and by doing this differently in adjacent circuits—so that, speaking generally, of any two adjacent circuits, each should have its neutralizing crossings at points substantially midway between two crossing points of the other. It is this system of reciprocal neutralization that has become widely known as "transposition."

The modern poly-conductor cable is one of the great triumphs, not so much of new invention as of intelligent and persistent development in plan and manufacture. Within the last ten years 1,200 wires was the largest number that could be placed in one cable sheath. But now such a cable may (and often does) contain as many as 2,400 wires; all satisfactorily operable. This wonderful improvement in cables began with the use of suitable paper as a material for the non-conductive separation of the contained wires. The insulation thus comprises both the paper itself and the air it holds.

Invention relating to the telephone circuit as a whole must not be neglected. While many of its exemplifications are of minor character, a few stand out as being of high and far-reaching consequence. This class of advances includes the invention and general introduction of central energy systems and methods; the advent of the telephone repeater or amplifier; the devising and adoption of means for the avoidance or mitigation of disturbances accruing from outside systems of electrical utilization; protection from destruction or injury due to heavy currents or discharges; the development of radio transmission, comprising wireless telephony; and the remarkable work which, including a host of small inventions and some large and important ones, has lately been accomplished in multiplex telephonic and telegraphic transmission, whereby one pair of wires is made available either for five simultaneous telephone conversations, for forty simultaneous telegraph messages, or partly for one and partly for the other.

THE CENTRAL ENERGY SYSTEM

The central energy system, as most of us know has now been in operation some twenty years, and its development is fully detailed in a paper on "The Evolution of the Telephone Switchboard," prepared by me for the American Institute of Electrical Engineers, and read before that body, January 23, 1903. It is, therefore, ancient history, but so important is its place in the annals of the telephone that any such address as this cannot fail to give it prominent notice. It combines a number of seperate inventions, is now in operation in all of the great telephone exchanges of the world, and concerns all of the three classes of operation to which I have advertised, viz.—talking, switching, and signaling.

It substitutes a central and common source of electrical energy always under the inspection and supervision of experts, and usually consisting of from twelve to twenty storage cells and a dynamo to charge them, for multitudinous local batteries, one at each user's station, which previously were in universal employ.

It comprises: First, a plan for supplying the telephone transmitters of the users' stations with current generated by the common central station battery; and second, a plan for central station call, supervisory and disconnect signals, all automatically operated from the users' stations, but by current from the same central source.

Before this system was introduced,

the numerous local batteries at the users' stations required to be constantly watched and regularly renewed, and yet were a prolific cause of complaint. But the central energy system, having enabled these and the magneto generator to be dispensed with, leaves, as the user's station apparatus, only the call bell, the telephone instruments, and the usual automatic suspension switch operated by the removal and replacement of the receiver, from and to its support on the switch lever, and connected to control the main circuit and thus operate the call and other signals by the simple act of removing the receivers from its support for use, and by its replacement at the close of the conversation.

A TIME ECONOMIZER

I have remarked already upon the importance as a time economizer, in establishing switch connections, of the multiple switchboard; and may now add that, by combining with that switchboard the central energy system of apparatus and operation, a further and similar time economy is effected by the facilitation of prompt disconnections.

In regard to amplifiers, I may refer to the fact that the vacuum tube amplifier was preceded by the attainment of a very considerable improvement in the self-suggestive type of receiver-microphone repeater. This instrument aimed at a great reduction of inertia in the moving parts, and reduced the packing of the carbon particles in the transmitting element by dissipating the heat to which it was attributable. This instrument was distinctly serviceable, represented a marked advance over anything of the kind thus far produced, and tended strongly to encourage continued research.

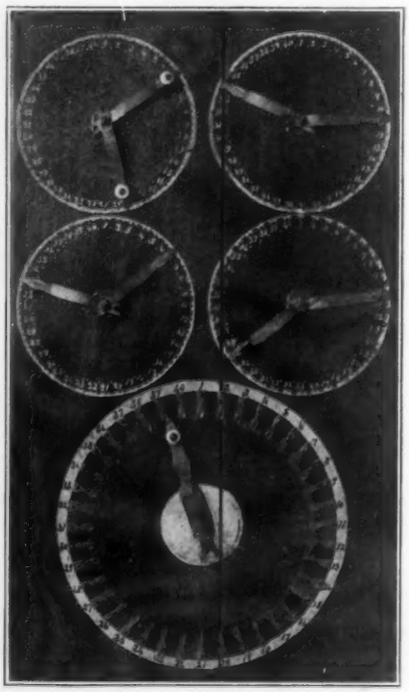
The vacuum tube amplifier is a development of the "audion" (so-called) of De Forest, and consists of an evacuated glass bulb with three electrodes sealed in it, one of them a filament like that of an incandescent lamp being maintained in a state of glow by an electrical current through it, another formed as a grid, and the third a plate. The input circuit is connected with the filament and grid, and the output or second circuit with the filament and plate.

The grid is maintained negative to the filament in the input circuit leading from the original transmitter, and the filament is negative to the plate in the output circuit leading to the ultimate receiver. The variations from the original transmitter reach the grid and vary its electrical condition and that of the space within the bulb, and thus bring about corresponding changes in the output circuit, and these passing over its line act on the receiver at the far station to reproduce the original sounds.

The audion relay is practically a valve device, responsive to the electrical variations produced in the grid; and becomes in fact the voice of the second circuit, which having the advantage of a new source of electrical energy operates to carry along the original impulses of the transmitting circuit, maintaining them unchanged in character or form, and, because of the new source of energy, or renewed strength.

Time will not permit me to enlarge upon the advances achieved in other branches of this class; and I must be content with a realization of the circumstances; that I have indicated them, and that they are making continued progress.

But I think I have sufficiently canvassed the subject in its broader aspects to show beyond question that the telephone industry, and in particular the Bell System, was founded on invention, has grown great by invention, is sustained by invention, and will cease to expand if and when invention ceases; but will by invention be perpetuated, because the constant study of its technical problems and the invention which is the result of such study will also be perpetuated.



An old handmade switchboard in Livingston, Wisconsin, capable, doubtless, of "doing duty" still—but goodness, wouldn't you hate being the operator?—Bell Telephone News.

To Spend Million in Arkansas

The Southwestern Bell Telephone Company will spend $1,000,000 in the State of Arkansas on improvements and extensions to its plant during the coming year, according to General Manager S. C. Paage, who says that the company is permitted to undertake this pretentious program now that the rate question is settled.

"This program is considerably in excess of any attempted by the Telephone Company in previous years, and is more than twice the amount expended in 1918," said G. A. M. Johnson, local manager, today. "The company in 1915 spent $371,000 in improvements, and in 1916, the outlay amounted to $387,000.

"Among the items affected by the new program are: Right of way, land, building, central office equipment, subscribers' station equipment, etc.

"It is estimated by Mr. Paage that the carrying out of the program will result in an increase of approximately 4,300 subscribers' stations during the year, approximately 1,600 wire miles of additional toll facilities and 435 miles of pole construction work.

"Another project affected by the program is the laying of a submarine cable across the Mississippi river at Helena.

"Practically every large town in Arkansas will be affected, including a large number of the smaller towns."

Pay Subscribers $50 For Use of Telephone

The purchase of telephone facilities from subscribers at $50 per night was reported in Texarkana, Ark., by visitors from Shreveport who stated the service is so cramped that the telephone company is unable to promise many applicants any definite time for installation. In order to secure their telephones new subscribers are said to buy out the connections of others.

Airplane Passengers to Talk to London

Passengers aboard London-Paris airplanes may soon be able to call up London by wireless telephone and be connected directly with any telephone subscriber in the city.

This is to be made possible by a wireless station with a 1,500 mile range installed on the top of the new air ministry building in the heart of London, which is now nearing completion

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

By FRED W. SCHOLZ

The French Cryptophone, or Secret Telephone

AT a meeting of the *Academie des Sciences*, M. J. Carpentier presented a paper by M. E. Poirson, treating a development of the telephone which promised to make possible secret communication and permit no interference from outside sources, thus making the telephone communication a real secret. The inventor called his secret telephone the Cryptophone, and the publishing of this news aroused quite a little discussion in the French press, not only the technical press, but even the lay papers. The papers, however, worked first under a wrong assumption. According to Carpentier's first discussion, it seemed that the secret of telephonic communication was obtained by imposing electric current impulses over telephone currents, which would cause a sharp crackling noise in any other telephone apparatus not equipped with the device to eliminate this noise, and thus prevent listening in on the conversation. It seemed from the discussion that the instruments themselves were not affected by the current impulses. It might be interesting to mention here that similar experiments to keep telephone communications secret were made in Europe as far back as 1915, primarily for military field-telephone equipment, and that the disturbing current impulses were made harmless for the stations that were entitled to converse with one another by means of specially constructed coherers.

Since the first news was received by the press, more details have been published by Génie Civil, which show that secrecy is not obtained by using additional current impulses, but by employing mechanical transformation of the telephone currents.

The basic thought of the device is built up on the following observations:

Interruptions per second:	Observations:
0 to 125	voice very much changed; interrupted, inaudible.
125 to 170	voice less changed; communication clearer.
210 to 270	voice very much changed, interrupted, hardly understandible.
290 to 300	voice improves; communication clearer.
400 to 1500	voice broken up; almost impossible to understand.
2000 to 2500 and above	above 2,000 periods the voice is unchanged; the words are clear and sounds pure.

In the above experiments the telephone current circuits were alternately closed and opened for the same period of time.

(b) The telephone current circuits are not interrupted in the second series of experiments, but are sent into the line in a reverse direction. In this way the telephone current is transformed and this transformation increases with increasing number of transformations. Speech becomes entirely incomprehensible and one seems to hear a foreign language. The observations gave these results:

Whistling tones are given back through the telephone false and distorted, and at 3,340 transformations the word "allo" is given back as "oya," and vice versa.

Transformations per second.	Observations:
0 to 100	speech can be understood, but seems as if speaker had a bad cold.
150 to 170	speech can be followed; person seems to speak a little clearer.
200 to 250	speech can be followed, but shows greater changes.
250 to 300	speech can be followed; less changed.
300 to 600	speech less clear, change increases.
600 to 1000	speech cannot be understood but there is a faint whisper in the telephone which can be followed.
1050 and over	Above 1050 speech remains incomprehensible.

In order to transform the communication back to normal at the receiving end of the line, a current transformer must be used for the second period of time. Both of the transformers at the receiving and at the transmitting station must work in synchrony. This condition is obtained by means of two small direct current motors, which receive the weak synchronizing current over the wires by way of simultaneous switching equipment.

The Cryptophone was first developed for military purposes under the guidance of General Ferrié. Each military telephone post was equipped with a transformer which would transform the currents in either direction, reversing the normal current sent out by the station or else transforming back the reversed current received. Thus conversation can be carried on in both directions and yet, except for those two stations, it is entirely incomprehensible to other stations, bringing about the secrecy of communication desired.

The connection for synchronizing the small motors mentioned before can be obtained by using the telephone wires themselves with the ground, making a phantom circuit. Each of the small motors is operated by its local battery, and the telephone line need only carry the very feeble synchronizing currents. Regulating the phase to be employed by the synchronizing apparatus is also obtained at each station by a mechanical equipment. Numerous experiments have been made in France with lines having a length of over 360 miles with great success. Up to the present no greater details of the mechanical and electrical equipment are available, but it may be that at some future time the French electrical press will bring out an article showing the detailed working of the Cryptophone, which will then be available to our readers. —*Le Genie Civil.*

American Telephone Equipment in French Hands

The French Department of Postal Service and Telegraph Service, which also includes telephone service, has taken over the enormous equipment sent over to France by the American Expeditionary Forces after the entry of the United States into the war. The *Annales des Telegraphes et Telephones* is quite elated over the acquisition of the large stock and equipment of our army at what the French state very advantageous conditions, which means probably cost or below cost.

When the first American forces landed in France in June, 1917, the staff immediately conferred with the French administration for closer communication between the French telegraph and telephone department and our American Signal Corps. The Franco-American conference, which consisted of the representatives of the American Signal Corps, the representatives of the French service of communication (the army) and a member of the Department of French Telegraphs and Telephones agreed finally to a recommendation to be made to the American government that the equipment used by the American army and the telegraph and telephone installations set up by the American army be taken over at the end of the war at a nominal figure.

The close relations established between the American and French authorities brought out the fact at the signing of the armistice that the American forces had at their disposal a well set up and well established system of communication, and that the mechanical and electrical equipment used was not only of better quality than the French equipment, but in most instances far more modern. The advantages were therefore all on the side of the French government, for the equipment transferred to them included not only the equipment of outposts, but the well developed exchanges at military bases, at staff headquarters and at the central headquarters in Paris.

At the time hostilities ceased, the American army possessed at the various supply depots in France an immense stock of telegraph and telephone equipment which had never been used and was sold according to the previous agreement to France in a lump sum. Considering the state of the invaded portions of France and considering also that the French telegraph and telephone industry will probably find itself crippled for some time to come, the offer of the American government was accepted with great pleasure by the French. It might be interesting to note that according to the French themselves, other departments had received analogous offers from the American government but had not taken advantage of them. Of all the various French departments, the Telegraph and Telephone Administration made the most advantageous transaction with the American government. According to the agreement, the dollar value of the equipment was to be exchanged for the French equivalent at the rate of 5 francs 45 centimes for the dollar, which is exceedingly profitable for the French, the value of the franc having dropped to the present exchange of 15 francs to the dollar. This value was to be used in payment, no matter when the equipment was released, a clause which saved the French government about 40,000,000 francs. A second advantageous clause was a reduction of the price to be paid by the French by 15 per cent below cost of the material in the United States during the period 1917. As this price was lower than the price for similar material at the same period in France, it can be seen what the French saved. In addition there was a proportionate reduction in the price for used material. The total value of the material handed over to the French government amounted to 59,000,000 francs, at a cost to the United States of how much?

Telephone Equipment: Among the more important parts of the telephone equipment are a large number of telephone relays of the Western Union type. The two types are adapted both to short distance and to long distance communication. Several of the most recent types installed by the Americans have been kept in the French service and are used at present for civil communication; others are ready to be installed at the first opportunity. There are 12,000 standard switchboards for from six to twelve connections for local battery service. Then there are 20,000 to 25,000 subscribers' telephones of both the wall type and the desk type. The number of smaller details of equipment necessary for all kinds of telephone service counts into the hundreds of thousands. Finally there is an immense number of measuring instruments, like ammeters, voltmeters, fault location instruments, Wheatstone bridges, etc.

Of line material there are more than 1,000,000 insulators of all types; there are thousands of miles of copper and iron wire, and then we find thousands of parts of equipment and devices that have never been used before in France, and which will give to the French telephone service a more modern equipment than they could ever hope to receive under normal conditions.

Of underground line material there is more than 1,000 miles of lead-sheathed and paper-insulated cables for conductor pairs from one to one hundred. This stock will render the French government a tremendous service at a time when raw materials are hard to obtain and where the exchange values are decidedly against France.

Besides there are many thousands of line repair tools of all kinds, as needed by linemen, repairmen and telephone men in general. Similar things may be said of the telegraph material sold to the French.

Wireless Telegraphy With Infra-Red Rays

The French Academy of Sciences some time ago listened to a lecture given by M. Branly on the use of infra-red rays in wireless telegraphy. The details of the proceeding were worked out by Messrs. I. J. Herbert-Stevens and A. Larigaldie.

Long before wireless telegraphy was discovered and made useful to man, light waves were used to give long-distance signals. Equipment used for this purpose consisted of a searchlight with a light arc as sender and a mirror to catch the pencils of light and cluster of rays on the receiving side. The mirror had in its point of focus a detector for light waves. To give signals the entire spectrum was used.

The recent war brought up the idea to make possible a sort of secret wireless telegraphic means of communication by shutting off the visible rays and using only the invisible rays for communication. The above mentioned older types of equipment, however, are only feasible for very short distances. Stevens and Larigaldie have developed this system so far that they can obtain good communication for a distance of 20 km. (12 miles). As detector for the dark, lightless rays they used a thermo-electric couple of great constancy and special sensitiveness.

The visible rays were caught in these tests by a light filter of smoked glass, which uses up 50 per cent of the total available energy of light and allows no rays visible to the human eye to penetrate.

For receiver a parabolic mirror is used in whose focal point the thermo-element is placed. This element, whose inertia is almost zero, consists of a metal plate 1/100 mm. thick, which is soldered to a crystal point of exceedingly great thermo-electric sensitiveness. The thickness of the metal plate and the diameter of the contact point are small, in order to avoid a heat capacity of any magnitude at the point of soldering. The

best results were obtained with a platinum plate and a tellurium crystal, which is hardened and soldered in keeping with the crystalline structure of the tellurium. The place where the plate and crystal are soldered together is enclosed in a glass vessel, which is provided with a fluor-spar window. The sensitiveness of this element was so great that it showed a current even when some person was present at the other end of the long corridor away from the laboratory room, which was 180 feet distant. The concave mirror used has a diameter of 25 cm. The radiation emanating from the head of the person standing at this distance of 180 feet, which was caught up by the mirror and transmitted to the thermo-element, was sufficient to operate the mirror.

The thermo-element is connected to the wires leading to a cathode strengthening device; its direct current is interrupted by a buzzer having the frequency of a musical tone. Connected into the current circuit is a potentio-meter which will cut out all currents that might affect the constant temperature at the soldering points. The decrease of the radiated energy going out from the receiver is fundamentally proportional to the distance between transmitter and receiver station. In practice, however, consideration must also be taken of the absorption of rays by the atmosphere, which is at times weaker, at times stronger, depending on the saturation with water vapor, fog, dust, carbon dioxide, etc. If the thermo-electric couple is used for other purposes than for wireless telegraphy, as for the indicating of bodies with certain temperatures differing considerably from the temperature of the surrounding bodies (steamships during a fog, icebergs, etc.), the current of the couple is made to react upon a sensitive galvanometer, which shows an indication of 3 to 4 mm. at a current of 10^6 amperes.

When making practical wireless tests good results were obtained at distances between transmitting and receiving stations of 14 km. (6.4 miles) and again for stations only 4.5 miles apart. In the latter case the transmitting station used a mirror of 40 cm. diameter and an electric nitrogen lamp of 800 watts, and the receiving station used a gold-plated mirror of 25 cm. diameter.—*Academie des Sciences*, France.

Selection of Wood Poles for Telephone Lines

The object of the present discussion is to develop equations for the proper selection of wood poles for the use of low-tension wires, particularly for telegraph and telephone lines. The two types of poles to be discussed are first the ordinary wood poles, standing alone, and then so-called double poles, which stand close together and are placed diagonal to the direction of the line. This latter type (double poles) we will call in the present discussion D-poles and for the single poles we will use the letter E, calling them E-poles.

The supply of poles for telephone work, while not at all exhausted, has been decreased during the last two years owing to the greater needs of the war in the line of labor and materials. Therefore in many sections it became impossible to obtain exactly the kind of timber needed for these poles, and recourse was necessary to timber, inferior in grade and strength, but which had to be made to serve the purpose owing to necessity. In some cases it became necessary to use the double-pole construction even at a greater expense, in order to obtain the proper factor of operating safety.

The equations set up for the computation of preserved poles is the following: For single poles: D_e = the sum of the wire diameter of a telephone line read in meters (1 meter = 3.28 ft).

H_e = the average height of the lines from the ground in meters.

H_{1e} = the total height of the poles from the ground in meters.

S_e = the distance between two adjacent poles in meters.

Z_e = the diameter of the top of the pole in centimeters (1 cm. = 0.39 inch).

The equation for preserved single poles is therefore expressed by the following:

$$Z_e = \sqrt[3]{580 . D_e . H_e . S_e + 100 . H_{1e}^2 - H_{1e}^3} - \frac{H_{1e}}{2} \quad (1).$$

We now take up the double pole equation:

D_d = the sum of the wire diameters of a telephone line in meters.

H_d = the average height of the lines from the ground in meters.

H_{1d} = the total height of the poles above ground in meters.

S_d = the distance of span between two adjacent poles.

Z_d = the diameter of the top of the poles in centimeters.

The entire equation for double poles is therefore expressed as follows:

$$Z_d = \frac{\sqrt[3]{580 . D_d . H_d . S_d . + 100\ H_{1d}^2 - H_{1d}^3}}{5} - \frac{H_{1d}}{2} \quad (2)$$

Now, if it is a question of determining single or double poles for a certain line, whose span is neither S_e nor S_f, we can substitute: $D_e = D_f$; $H_e = H_s$ and $H_{1e} = H_{1d}$ or else we can rewrite the equations (1) and (2) as follows:

$$\frac{\left(Z_e + \frac{H_{1e}}{2}\right)^3 - 100 . H_{1e}^2 + H_{1e}^3}{580 . H_e . S_e} =$$

$$= \frac{5.\left(Z_d + \frac{H_{1d}}{2}\right)^3 - 100 . H_{1d}^2 + H_{1d}^3}{580 . H_d . S_d}$$

If we now designate the magnitudes H_e H_d; H_{1e} H_{1d}, which here have equal values by the forms H and H_1, the equation will be changed to:

$$\left.\begin{aligned} &\frac{\left(Z_e + \frac{H_1}{2}\right)^3 - 100\, H_1^2 + H_1^3}{580 . H . S_e} = \\ &= \frac{5.\left(Z_d + \frac{H_1}{2}\right)^3 - 100\, H_1^2 + H_1^3}{580 . H . S_d} \end{aligned}\right\} \quad (3)$$

and from this we obtain:

$$Z_d = \sqrt[3]{S_d \left(Z_e + \frac{H_1}{2}\right)^3 - 100\, S_d . H_1^2 + S_d . H_1^3 + 100\, S_e . H_1^2 - S_e . H_1^3} - \frac{H_1}{2} \quad (4)$$

and:

$$Z_e = \sqrt[3]{5 S_e \left(Z_d + \frac{H_1}{2}\right)^3 - 100\ S_e . H_1^2 . H_1^3 + 100\, S_d . H_1^2 - S_d . H_1^3} - \frac{H_1}{2} \quad (5).$$

If the width of span is $S_e = S_a$ we can write in the case of equation (4) the following equation:

$$Z_a = \sqrt[4]{\left(Z_e + \frac{H_1}{2}\right)\frac{}{5}} - \frac{H_1}{2} \quad . \quad . \quad . \quad . \quad (6)$$

and in the case of equation (5), we can write:

$$Z_e = \sqrt[4]{5 \cdot \left(Z_a + \frac{H_1}{2}\right)^4} - \frac{H_1}{2} \quad . \quad . \quad . \quad (7).$$

If we assume the height H_1 above ground to be as follows:

for poles of 7 8 9 10 11 12 13 meters height,
H_1 will be 5.6 6.6 7.5 8.5 9.4 10.3 11.1 meters.

and if we assume that double poles cannot be chosen with a top of smaller diameter than 10 cm. (3.9 in.) then we can place the following strength poles opposite each other as giving the same factor of safety and of strength:

7 meter D-pole with 2 x 11 cm. top equal to E-pole with 20.8 cm. diameter top.
8 meter D-pole with 2 x 11 cm. top equal to E-pole with 21.1 cm. diameter top.
9 meter D-pole with 2 x 11 cm. top equal to E-pole with 21.5 cm. diameter top.
10 meter D-pole with 2 x 11 cm. top equal to E-pole with 21.9 cm. diameter top.
11 meter D-pole with 2x11 cm. top equal to E-pole with 22.2 cm. diam. top.
12 meter D-pole with 2x11 cm. top equal to E-pole with 22.5 cm. daim. top.
13 meter D-pole with 2x11 cm. top equal to E-pole with 22.7 cm. diam. top.

It is evident from the above table that poles having the same span of wire between adjoining poles, if used in pairs, need only have about half the diameter of single poles at the top, at the same time giving the same strength and factor of safety. This factor of safety is especially noticeable in the matter of resistance to wind pressure, as the diameter of the double poles is more favorable to greater wind resistance and offers less surface to the wind, owing to the smaller diameters.

Objection might be raised that the thinner poles used for double pole construction might be cut from the top ends of tall trees and thus have a smaller factor of resistance than the thicker single poles which are cut from the lower part of the tree. To investigate this just criticism and to see whether the equations given previously apply under these unfavorable conditions, the following breaking tests were made for experimental purposes:

Test 1: A tall, slender fir tree, its bark removed but not scraped, grown on mountain slopes, of average height, being 18.2 m. (60 ft.) tall and with a diameter of 21 cm. (8.1 in.) at the base and 12 cm. (7.6 in.) at the top, having 76 annual rings, showing an age of 76 years, was set upright in the ground.

In the following L is the length from the point of support, or ground line, to the point of strain. P is the point of strain or pull, near top of pole. A is the deflection of top of pole; d is the point of support. L_1 is the distance from point P to point of fracture; d_1 is the point of fracture.

(a) L was equal to 16.74 m. (55.24 ft.); with a horizontal $P = 260$ kg. (572 lb.) and a bending A at the top of the pole of 4,340 mm. (168.26 in.), the pole broke 800 mm. (31.2 in.) above point a, or at $L_1 = 15{,}940$ mm. (751.66 in.). At the breaking point $d = 199$ mm. (6.5 in.), as proved by measurements above and below the breaking point. This gives a breaking strength of 537 kg./sq. cm. (7,625.4 lb. per sq. in.).

(b) The upper section of the same pole was again set up and tested to the breaking point, with these results:

$L = 9{,}818$ mm. (382.9 in.)
$L_1 = 9{,}138$ mm. (356.38 in.)
$A = 2{,}550$ mm. (99.45 in.)
$P = 277$ kg. (609.4 lb.)
$d_1 = 171$ mm. (6.66 in.)
Result: 516 kg./cm.² (7,327.2 lb. sq. in.)

(c) The rest of the same pole was again set up and tested to the breaking point with these results:

$L = L_1 = 4{,}825$ mm. (185.17 in.)
$A = 1{,}800$ mm. (70.2 in.)
$P = 414$ kg. (910.8 lbs.)
$d = d_1 = 150$ mm. (5.85 in.)
Result: 605 kg./cm.² (8,591 lb. sq. in.)

A second test was then made with a fir pole coming from the same location as the first one, but of 15.5 m. (51.15 ft.) height and 21.5 cm. (8.3 in.) diameter at the base and 13 cm. (4.2 in.) diameter at the top. This fir tree was 67 years of age. The results were as follows: 488 kg./cm.² (6,929.6 lb. sq. in.) for the first test; the second broken off section was tested to 546 kg./cm.² (7,763.2 lb. sq. in.); the third broken section gave 531 kg./cm.² (7,540.2 lb. sq. in.) breaking load. In all these tests the breaking strength was computed in relation to the position of the point at which the break occurred. The deductions we can draw are that even thinner poles, as used in double pole construction, will give practically the same strength as the heavier poles used in single pole construction. This, of course, presupposes that the timber is cut in about the same location and that no rotten wood is used for poles. Even poles cut from the upper ends of tall trees will give satisfactory results, provided they were grown in timber land on ranges of average height and that the poles show an average breaking strength of from 500-600 kg./cm.² (7,100-8,520 lb. sq. in.).

Tests were then made to determine the tensile strength of the poles at the breaking point. Various size pieces were taken from the poles above and below the breaking point and subjected to a tensile stress until the fibers of the wood were pulled apart. Indications point to the conclusion that the outer portions of the timber have a much greater resistance against tensile stresses than the inner deadened portions. The base and thicker end of the pole likewise offers a much greater resistance to tensile stress than the portions near the top of the tree, which might be expected in spite of the breaking load tests, which showed better figures for the upper sections of the poles.

The general strength of a pole is greater near the base than near the top, but is greatest near the center of the pole, because here there is much more young, living, strong wood, which is not the case to such a high degree at the base, while at the top the wood is still too young and tender. It might be added that all single poles can be replaced if need be by thinner double poles, which are closely united to each other by means of bolts and should each have a minimum diameter at the top of 10 cm. (3.9 in.).—*Elektrotechnik u. Maschinenbau.*

The British Telephone Service

A deputation from the British National Union of Manufacturers waited upon the Postmaster-general in London in order to make representations on the present inefficient service, and to suggest that a committee of business men be associated with the department in the reorganization of the service.

In the course of his reply, Mr. A. Illingworth said that when the government took over the service from the National Telephone Company there was practically no spare plant, and the position was far from satisfactory. In 1913 and 1914 the sum of $6,750,000 per year was laid out by the Post Office, but during the rest of the period of the war, up to March last the sum spent was only $1,400,000 a year, on account of the shortage of material and men. There were practically no extensions except for absolute war work and for government departments. There was a great shortage of switchboards: they were not being made because there was no one to make them. As soon as the armistice was signed, the government went into the telephone question carefully, and drew up a program for this year. Under that program they intended to lay out $15,000,000 on new exchanges, improvement of lines, extra lines, extra switchboards, and generally make a beginning to get the service back into some satisfactory condition.

There were difficulties arising from shortage and inexperience of the staff. In 1914 there were only 4 per cent of the operators who had less than six months' experience. Recently the average was over 45 per cent. Over 1,000 trained operators were taken for various government private exchanges. A few of these had been returned, but there were still 800 highly skilled operators working in various government departments. It took six months to train operators to be of moderate use, and 18 months to two years to make them fully efficient. Before the war, girls of 18 received $4 a week, which increased to $7; now they were starting at $9.50 per week, which rose to $13. The greatest care was being exercised to get the best material, and only something like 10 per cent of those who presented themselves were employed. Recruiting was improving, although it was made difficult by the way in which telephone operators were abused by the press. In spite of all that abuse, the recruiting was improving. The traffic, of course, had increased enormously. Before the armistice the calls in London were rather under 1,000,000 a day; now they were rather over 1,250,000.

The remedy for the present state of affairs was perfectly obvious. They had to have increased accommodation, increased wires, trunk lines, exchanges and exchange boards, and they wanted a larger staff so that the operators would have a comfortable amount of calls to deal with. In London since the armistice they had put in 14,000 lines, and at present they were doing them at the rate of 900 a week. They were laying wires underground in 20 large towns, so that they would not be broken down by storms. He outlined the program of work for the present year, which was laid before the House of Commons in July. He hoped the Clerkenwell exchange, which would accommodate 1,700 lines, would be opened in December or January. Other new exchanges to be opened were Bishopsgate, Tower, Holborn, Strand, Sloane-square and Marylebone. Some of these had been begun, and they were all going to be pressed forward as quickly as they were able to get material and labor. Extensions were to be carried out at the Avenue exchange, Chingford, Hamstead, Harrow, Hornsey, Battersea Park, Stratford, Tottenham, Victoria and Waltham Cross. With the exception of two, these would be opened before next June. As to the appointment of a small committee of business men, he pointed out that one committee to deal with the subject would be kept working night and day for a long time. There were 50 committees of business men already in existence up and down the country. The London committee represented the Chamber of Commerce, the Corporation and the London County Council. He arranged some months ago to send experts to America to look into the telephone system there, and there were at present some American experts in England looking into that system.

Referring to the complaints about the telegraph service, Mr. Illingworth said that, while mistakes were made, the British telegraph system was admitted to be the best in the world. He could assure them that mistakes complained of would be inquired into. As to the question of telephone charges, the government had been considering the passing on of the extra charge to the consumer. They thought that, at any rate for the present, while trade was in a transition period, it would be more desirable to keep up communications as cheaply as possible, and really the post office was now being subsidized by the treasury. He beliveed that the deficit this year would be two millions.

Telephones of Foochow, China

The Foochow Telephone Company is controlled by the same group of Chinese who control the Foochow Light Combpany. During 1918 a total business of $43,000 was done, of which $11,650 was profits. The system is the double-wire system and operators, who speak English, are employed for the benefit of the foreign subscribers. The operators total 40 in number and the subscribers 592. The charge for an ordinary wall telephone is $46.60 per annum; for mitrophone, $55.92 per annum, and for a switch telephone in connection with a wall telephone, $27.96 per annum is charged.

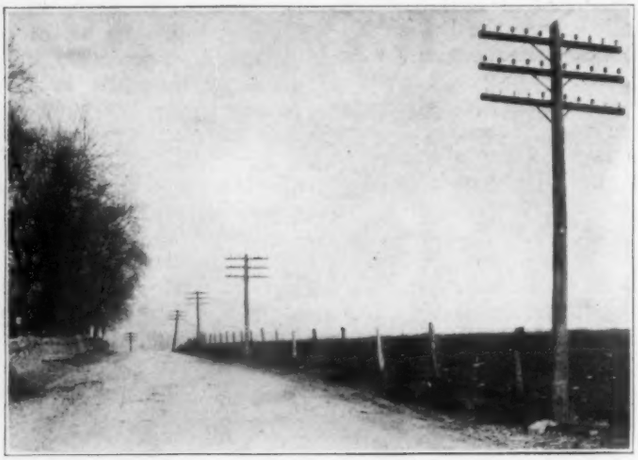
The Chinese Government Telegraph Administration maintains 24 stations in inland places in the province. These stations are connected by 600 miles of line. Four of these stations and 80 miles of line were added in 1918. During the recent revolutionary troubles eight of the stations were captured by rebels or brigands. Besides the Chinese telegraph office at Foochow, there is an office of the company. At Sharp Peak, an island at the mouth of the Min River, the submarine cable of this company connecting Shanghai and Hongkong is landed. Three foreign operators live and are on duty in turn at this island station. A line from Sharp Peak to Foochow connects this city with the cable and hence with the outside world.

Wireless telephone communication between Miami and Bimini, in the Bahama Islands group, will soon be possible it is announced. The apparatus is being set up on top of one of the fashionable tourist hotels in Miami.

Views of the Central Home Telephone and T

Above, Methods of Tree-Trimming Used by the Experts of the Central Home Telephone and Telegraph Company. Trees in the Foreground Have Been Trimmed. Those Beyond the Center Pole Have Not.

Below, the Business Office of the Owensboro Exchange of the Central Home Telephone and Telegraph Company.



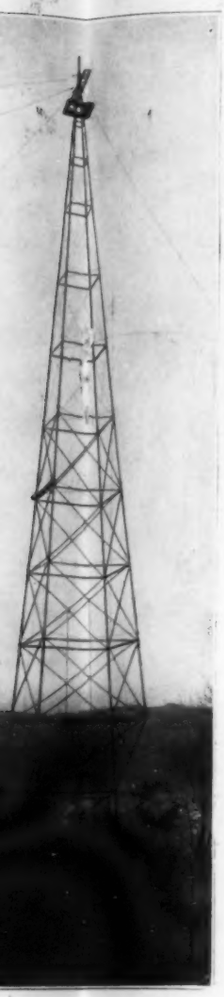
Above, a Pole Line of the Central Home at Cynthiana, Kentucky. The Poles Are All Butt Heated with Carbolineum.

In the Near Pole Below, a Trace of the Carbolineum Butt Treatment is Faintly Visible. It Extends About Eighteen Inches Above the Ground.

Above, Steel Tower f 2900-Foot Span Across th River at Maysville, for Distance Service to Ohio.

Below, the Operating and Switchboard of the boro Exchange.

ephone and Telegraph Company of Louisville



ve, Steel Tower for the pot Span Across the Ohio at Maysville, for Long ce Service to Ohio.

w, the Operating Room witchboard of the Owens- Exchange.

Above, the New Owensboro Exchange Building of the Central Home Company. Picture was Taken Immediately After Building was Completed, Explaining the Absence of Signs.

Below, Another View of the Cynthiana Pole Line. Each Pole was Given a Fifteen-Minute Dip in a Tank Before Erecting, and After Twelve Years They Show No Ground-Line Decay and Look Good for Another Twelve Years.

Above, Another Tree-Trimming Picture. The Company Prides Itself on This Work, Which Compares Well With That of the State Foresters, and Has No Difficulty in Securing Privileges.

Below, the Terminal Room of the Owensboro Exchange, Showing One End of the Distributing Frames and the Wire Chief's Desk.

Move Entire Pole Line Without Service Break

Systematic Use of Pole Jacks Saves Time and Trouble

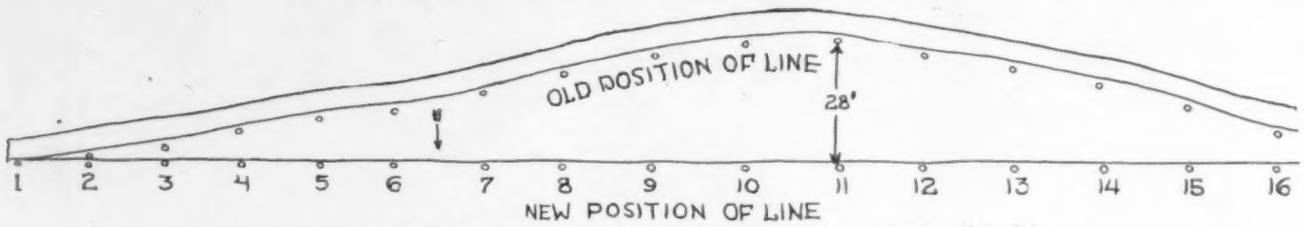


Diagram of the Old and New Locations of Poles, Showing the Amount of Lateral Shifting Necessary.

A SHORT time ago one of the large telephone companies was confronted with the difficult task of moving its poles, containing three crossarms of thirty wires, a distance ranging from one foot to twenty-eight feet to one side, because of right of way improvements, of which there was a great deal last year and of which there will be considerably more this year.

The system finally adopted by the company enabled it to move ninety poles the distance indicated in five days with twelve men, six of which were used for digging the new holes for the new location. Part of the five days was used in locating the new line. The six men who actually did the moving of the poles moved an average of twenty poles a day.

The method used in the past was to untie the wires on the second pole, remove the pole from old location to new, repeating this process on every other pole—the 4th, 6th, 8th, etc.—for some distance; then they would transfer the wires from the poles in the old location to the poles in the new location, after which they would go back and transfer the balance of the poles in the old to the new location, and tie the wires permanently on all poles.

Moving the poles by this method would have taken the above-mentioned gang at least five times as long, and they would probably have caused considerable circuit trouble by getting wires crossed, and there would have been a possible chance of some poles being broken in letting them down.

The diagram shows the old and new location of the line, as worked out. The old line followed the old road, which took a winding course through a woods, and before the new road could be built it was necessary to move the poles the distance mentioned in the first paragraph.

The method used was very simple. Pole number one was left in its old position, while pole number two was jacked up, with a simplex pole jack, clear of the hole and onto a plank. Then a butting board was placed in the new hole, and the pole was slid over into the new hole with the butt of the pole against the butting board, which forced the pole into the hole. Pole number three was then jacked up, and same process was used in placing it in its new position, which was four feet from the old position. The next five poles were moved in the same manner, as the distance from the old to the new position was from five to thirteen feet.

When they came to pole number nine the distance was greater, and it was necessary to jack up the pole and place it on a board, jacking it over about eight feet with the butt of the pole, facing the old hole. Then a digging bar was stuck into the ground at the butt of the pole, to prevent it from sliding back, and two pike poles were also placed against the pole on the side facing the old hole, to prevent the pole from kicking over.

After this had been done, they proceeded to the next pole, number ten, and jacked it up onto a board and slid it over about eight feet, blocking it so that it would not slide or kick over. This allowed them enough slack in the wires so that they could go back to the pole in back of them, number nine, and push it into its new position.

This operation completed, pole number eleven was jacked out on to the board and slid over about eight feet in the same manner. As the distance was so great, it was necessary to jack out another pole ahead on the line, before they had enough slack in the wires so that pole number ten could be pushed over into its new position.

This same process was used during the entire move. When the distance was about thirteen feet or less, the pole was removed from its old position and placed right into its new position. But when the distance was more, it was necessary to jack up two or three poles before there was enough slack to drop the pole into its new position.

In this case, the change could have been made in about two-thirds the time if the gang had had two simplex pole jacks, as there were times when several of the men had to stand idle while two of the men were jacking out the pole, and while the jack was being carried from one pole to the next. By having two jacks they could have worked three men at each pole, who could very easily handle a move like this without causing a case of trouble. No trouble was caused in the operation described.

An analysis of this operation shows that the total cost of moving the ninety poles with one simplex jack, based upon five days of eight hours each and at estimated rate of 50 cents per man-hour, was $240.00—a saving of $671.00 over the method formerly employed.

With two simplex jacks in use, the job would have been done in 3⅓ days at a cost of $156.00—a saving of $704.00 over the old system.

Illinois Bell Exchanges to Turn Automatic

An automatic telephone exchange is to be installed in Aurora this year, B. E. Sunny, president of the Chicago Telephone Company, announces.

Five new automatic exchanges are to be installed this year, according to Mr. Sunny. They are to be in the Chicago loop, Evanston, East Chicago, Ind., the Canal exchange district and Aurora.

Under the automatic system, only information and long distance operators will be necessary.

Telephone Repeaters

Presented at a Joint Meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers—Continued

By BANCROFT GHERARDI and F. B. JEWETT

THE third type of gaseous device which we have investigated as a possible repeater is the negative resistance type. A typical voltage-current characteristic for an arc stream is that of Fig. 24, where the ordinates give the impressed voltages

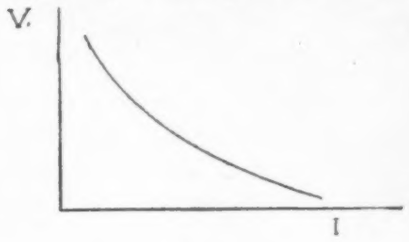


Fig. 24.

and the abscissas the resulting current.

For an ordinary resistance the slope of the relation of voltage and current is positive in the usual sense, since for any point on the curve dV/dI is positive, and represents a slope of less than 90 degrees measured counter-clockwise from the axis of I. For the arc, however, with its falling characteristic, the slope is negative. The resistance which the arc offers to a change in its condition is thus to be considered negative.

If an arc is connected in series with an ohmic resistance and a source of potential, as shown in Fig 25, which is essentially that suggested at one time by Hewitt, who dealt with a

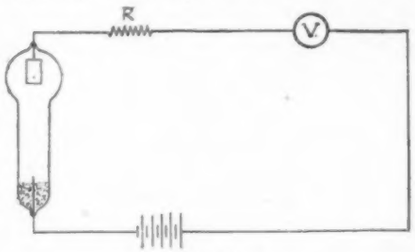


Fig. 25.

mercury arc in an enclosed tube, the arc, owing to its falling characteristic, has the effect of making the total resistance in the circuit appear to be less when small current variations exist in the circuit than when steady conditions exist.

The reason for this is that any small increase in current is accompanied by a decrease in the voltage across the arc itself, thus leaving a still greater voltage across the ohmic resistance than would be obtained if the circuit consisted merely of elements obeying Ohm's law. If the source, V, is a transmitter and if there is in the circuit also a receiver, then it follows that the energy received by the latter may, under proper conditions, be greater than that delivered to the circuit by the transmitter. In other words there is a possible telephonic amplification.

The magnitude of the amplification with the Hewitt device obviously depends upon the relative magnitudes of the negative resistance and the external ohmic resistance. The external resistance may in part be that of a telephone line and for that reason this method has been considered as a means of producing telephonic amplification. The negative resistance of the arc can never do more than remove some of the effects of the external resistance. If it could do more, of course, the circuit would "sing." We have found in practice that the system can never increase the loudness of telephone speech unless the line resistance itself is sufficient to stabilize the arc. In practise the arc would have to be connected to various telephone lines, each having different characteristics, and in order that an arc which will amplify, when connected to a high resistance line, shall not "sing" when connected to a line of lower resistance, a certain amount of extra external resistance has to be added to the arc circuit, which resistance will be different for each different type of line. For practical telephony, therefore, this negative resistance device is not of service.

Even if the possible amplification were sufficient under actual conditions there would still remain the fact that the dynamic characteristic of the arc varies with the frequency of the impressed telephonic waves, giving prohibitive distortion and variable amplification. Further, in common with the other types of gaseous discharge apparatus which we have considered above, the negative resistance device would be too unsteady for practical use.

The two devices which we have found practicable under the exacting requirements of commercial telephone service are the receiver-transmitter element and the three electrode vacuum tube or audion. The electromagnetically controlled arc stream with auxiliary electrodes, which, as

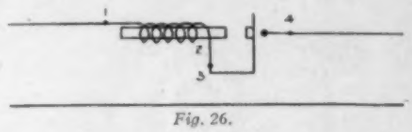


Fig. 26.

indicated above, has been used by us to a limited extent experimentally, and while possessing many of the characteristics of a commercial telephone repeater, is not in its present state of development adapted to general telephonic use. Of the three types, mechanical, electronic, and gaseous the electronic device with its thermionic emission is the most nearly perfect. In fact the amount by which it fails to meet all the requirements for a perfect repeater is so small as to be negligible except under the most rigorous conditions.

THE REPEATER CIRCUIT

The electrical network by means of which one or more repeater elements may be associated with the telephone lines is conveniently known as the "repeater circuit," as explained above. In two-way operation, such as tele-

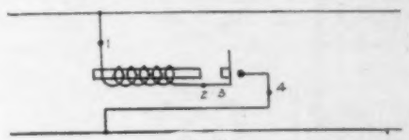


Fig. 27.

phony requires, there may be distinguished three general types of such circuits, of which the bridge or balanced circuit, described earlier in this paper, is the more usual type.

The other types do not depend upon balance for their successful operation. One of these is commonly called the "booster." Fig 26 shows one form of series booster, in which the input and output of the element are connected in series with each other and with the line. A form of shunt booster is similarly indicated in Fig. 27. A large number of other forms of booster circuit are possible.

Negative resistance devices are by their nature adapted to the booster scheme of connection.

In the case of booster circuits there is, for operation without sing-

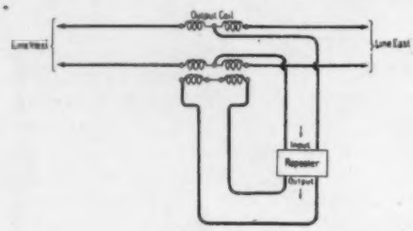


Fig. 28.

ing, a limiting relationship between the amplification for which the element is adjusted and the impedance of the line in which it is connected. Part or all of the output currents from the element must flow through the input circuit of the element itself, and thus the amplification of the incoming telephonic current depends upon the "building up" of currents in the circuit by the interaction of input and output. It is obvious that if the lines do not offer a sufficient load such a circuit with its element may act as an oscillation generator, that is, there may be singing.

The third type of repeater circuit is somewhat analogous to the single line repeater of telegraph practise. Incoming voice currents operate sensitive relays which switch the terminals of the element according to the direction from which the voice currents originate so that the circuit is equivalent at any instant to a one-way repeater circuit.

These types of circuit, which do not depend upon balance, have in general been found not so desirable for practical use as the bridge type

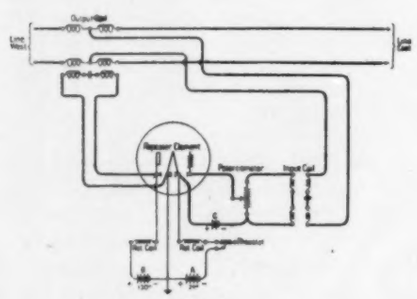


Fig. 29.

of duplex circuit and will not be discussed in further detail.

Of the bridge type we may distinguish two classes depending upon whether a single repeater element is used to amplify transmission in the two directions or whether separate elements are used for the opposite directions. The typical circuit shown in Fig. 28 is obviously of the first class. Such circuits we may call "21-type," indicating two-way, one-element circuits. The other class, which we shall discuss a little later, is generally known as the "22-type," since it is a two-way, two-element circuit.

The input and output terminals of the element in the 21 type circuit, Fig. 28, may obviously be interchanged without altering the physical operation of the circuit, in which case the element transmits to the two lines in parallel instead of in series. The choice between these two connections is influenced largely by the ease with which, through the medium of repeating coils, the input and output impedances of the element may be made similar to the impedances of the network to which they are connected.

A practical form of the 21 circuit is shown in Fig. 29 with its associated vacuum tube amplifier. The incoming energy is supplied through an input repeating coil, between which and the telephone lines is interposed a "filter," not shown in the figure. This filter, of which many satisfactory types have been invented by Dr. G. A. Campbell, is a physically periodic structure, consisting of similar networks in series, which is so designed as to discriminate against the passage of sinusoidal currents of frequencies above or below the necessary telephone range and thus prevents the element from receiving currents which arise from the simultaneous use of the metallic circuits of the telephone line for telegraph currents or other signal currents. The potentiometer is introduced to regulate the gain occasioned by the element. Retardation coils and condensers serve to prevent cross-talk into adjacent telephone circuits and to permit the use of a common battery to supply all the repeater sets at any repeater station. A rheostat is also introduced, as shown, to control the heating of the filament and thus its thermionic emission.

Before proceeding to describe the 22 type circuit we may well restate the physical operation of the 21 type in terms somewhat different from those used in our introductory discussion of the circuit. Let us follow the telephone current, assuming for the moment that it is traveling from west to east. The current that comes to the repeater from the west is partly transmitted through the circuit to the line east but the larger part of it is divided between the input and output circuits of the telephone repeater element. The energy which flows into the output circuit is merely dissipated. The energy which flows into the input circuit is amplified by the repeater element and the amplified current passes to the "output coil." At this point if the line west and the line east are similar in characteristics, the energy divides, half going to the east and half to the west. The half that goes west, that is, towards the direction from which the transmission came, serves no useful purpose. The half that goes east (combined with the small amount of energy that passed directly through the repeater) may be may times larger than the original energy coming from line west and is the useful amplified transmission.

When the lines west and east are identical in characteristics, it is evi-

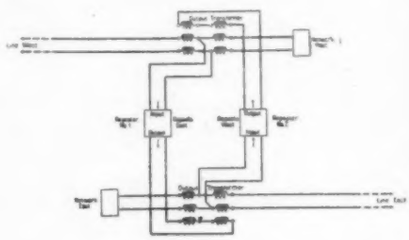


Fig. 30.

dent by symmetry that there is no voltage set up across the input circuit, and there is, therefore, no possibility of a "singing" condition no matter how large amplifications are employed. This circuit therefore permits two-way transmission over similar lines.

In case, however, the line west and the line east are different in their impedance characteristics for any part of the telephone frequency range, then for such frequencies there will be voltages set up across the input circuit due to current flowing from the output circuit and a tendency towards singing and distortion. The conditions which hold when such unbalances exist will be discussed later.

The duplex bridge circuit, as we saw from our earliest discussion, is applicable as a terminal circuit whereby two-way transmission may be had over a single pair of wires. (See Fig. 3, January number.) In such operation the telephone line is balanced by the inclusion in the opposite arm of the bridge of an artificial line of similar impedance-frequency characteristic. At a repeater station we may, therefore, terminate both incoming lines by bridge cir-

cuits, balance each line by an artificial line, and operate both lines as a through circuit for two-way conversations provided we connect the input branch of each bridge to the output branch of the other. In connecting the input terminals of one bridge circuit to the output terminals of the other bridge circuit we may introduce a one-way amplifier as shown in Fig. 30.

The resulting circuit is the 22-type defined above, although its evolution did not follow the line which we have just followed for simplicity of discussion. It will be noted that this circuit makes use of a separate repeater element for transmission west to east from that used for transmission east to west, that it requires two "output transformers," and that each line, instead of being balanced by the line in the opposite direction, is balanced by an artificial line indicated as "network west" or "network east." Assuming again the transmission to be coming from the west, we trace the currents through the repeater circuit as follows: A small part of the energy goes through into the network west; the largest part, however, is divided between the input circuit of repeater No. 1 and the output circuit of repeater No. 2. That part which enters the output circuit of repeater No. 2 is dissipated without doing useful work. The part reaching the input of repeater No. 1 is amplified and the amplified energy flows through the output transformer connected to line east. The "network east" is made to have as nearly as possible the same impedance as the actual line for the full range of telephone frequencies. If the balance were perfect, there would be no voltage whatever set up across the input circuit of repeater No. 2, and therefore no possibility of setting up a singing condition whatever values of amplification were used.

Actually, however, the balance can never be absolutely perfect, so that there will be a certain voltage set up across this input. This will, in turn, be amplified by repeater No. 2. These amplified currents will then flow through the output transformer connected to the line west. If the "network west" has exactly the same impedance as the line west, then the energy will equally divide between the two and there will be no voltage set up across the input circuit of repeater No. 1. This condition will then prevent any possibility of a singing condition being set up. Again, however, there will be in any practical case some unbalance so that a small voltage will be set up across this input circuit. If the two unbalances involved (*i. e.* line east against "network east" and line west against "network west") are sufficiently large, it is evident that the telephone currents have a closed path through the two repeaters and through these unbalances so that a singing condition may be set up.

This circuit is, however, very much more stable than the 21-type circuit. It will be noted that if either of the networks exactly balances its line, there may be any degree whatever of unbalance between the other network and its line without permitting singing. In general, the fact that the singing condition requires two unbalances simultaneously leads to a more stable condition.

There is another property of the 22-type circuit which is of great importance in connection with tandem operation of repeaters, that is, when two or more repeaters are used at different points in a line. As pointed out, transmission coming from the line west and reaching a 21-type repeater, as in Fig. 28, will result in an amplified current being sent out towards line east; but it will also result in an equally large current being sent back into line west. In the case of the 22-type, however, if the transmission comes in from line west and the balance between network east and line east is good, there will be very little energy sent back into line west. As will be pointed out in more detail below, under "Tandem Operation of Repeaters," this feature has a large advantage as the energy sent back into line west would react on any other repeater which was in circuit in that direction.

A 22-type circuit with vacuum

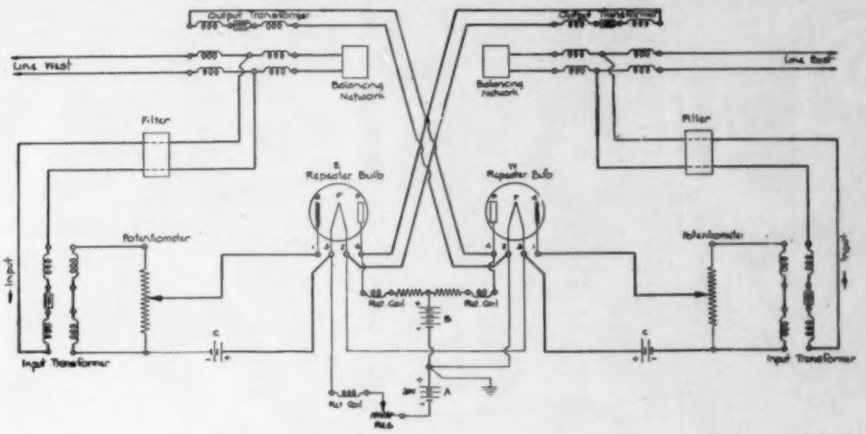


Fig. 31.

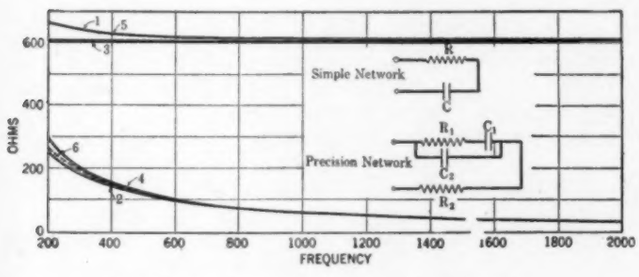


Fig. 32—Non-Loaded No. 8 Gage Open Wire Line.

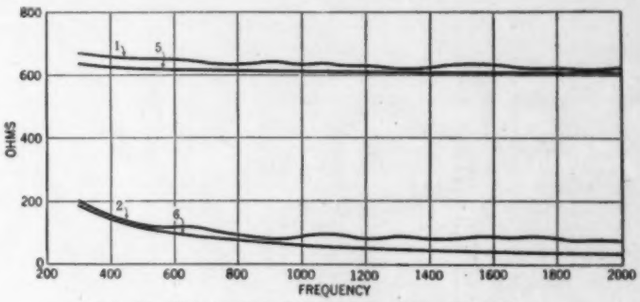


Fig. 33—Non-Loaded No. 8 Gage Open Wire Line.

tube repeater elements connected into it is shown in Fig. 31.

In connection with the presentation of the 22-type circuit it is interesting to note that this circuit, which is today the best known means of

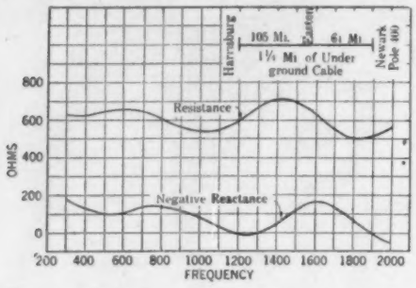


Fig. 34—Harrisburg to Pole 400 Newark, Wires 23/24 Coil Out at Easton

producing two-way telephone repeater operation with one-way amplifying devices, is the invention of W. L. Richards, one of the engineers of the Bell System, who devised and patented the arrangement in 1895—years before successful telephone repeaters were available for utilization in telephone systems.

BALANCING OF LINES

As pointed out above, the 21-type circuit depends for its stable operation on the balancing of the telephone line east against the telephone line west, and the 22-type circuit depends on the balancing of each of the telephone lines against an artificial line or "network." "Balancing" requires that the two lines or the line and its artificial line which are balanced agaist each other shall have closely the same impedance for the whole range of telephone frequencies.

Assuming that we have repeater elements which can give us sufficient amplification without appreciably affecting quality it is evident that the

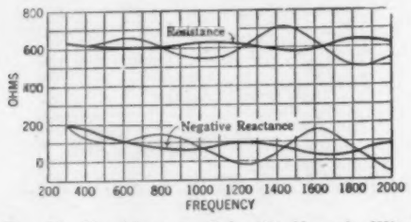


Fig. 35—Harrisburg to Pole 400 Newark, Wires 23/24 Coil in at Easton

amount of amplification which we can get in any practical case depends on the degree to which this balance condition can be carried. This in turn, as will be more evident after reading the further discussion, depends on line conditions. It is then the line conditions, rather than the repeater element or its circuits which finally limit in every practical case the amplifications which can be obtained with a repeater.

Let us consider, therefore, what the impedance of a telephone circuit looks like as seen from the repeater terminals.

TELEPHONE LINE IMPEDANCE

If we take a very long No. 8 B. w. g. open wire circuit, which is the largest size of copper in general use in the telephone art, and suppose this circuit to be absolutely uniform in its characteristics, then its impedance, that is, the ratio of the voltage applied across it to the current entering it will be as shown by Curves 1 and 2 in Fig. 32, in which curve 1 gives the resistance and curve 2 the negative reactance of the impedance.

For such a line we can make up a very simple form of network which has approximately the same impedance and can be used for balancing in a repeater circuit. Curves No. 3 and 4 of Fig. 32 indicate the impedance of a network consisting merely of a condenser in series with resistance. It will be noted that even this simple circuit is a very good approximation of the impedance of a long line except at low frequencies. Curves Nos. 5 and 6 show the impedance of a somewhat more complicated network, as indicated on the diagram, which gives a very good approximation over the whole telephone frequency range.

In a practical case every line has slight irregularities which affect somewhat its impedance. An impedance curve for an actual line which is, however, comparatively regular, is shown by curves 1 and 2 of Fig. 33. The measurements on this line were made with the end of it closed through an impedance similar to that of a long length of the line itself. Curves 5 and 6 are copied in from Fig. 32 for comparison.

It is difficult, however, to keep a long open wire circuit free from short stretches of cable. Fig. 34 shows both components of the impedance of a No. 8 gage circuit having a total length of about 165 miles with the distant end closed as before through an impedance equal to that of a long length of the line itself, but with 1¼ miles of underground cable at a point 105 miles from the end at which the measurements were made.

It would evidently be more difficult to make a network having the same impedance as this. It can be done, however, fairly simply by building an artificial line representing the 105 miles from the sending end to the place where the cable is located, putting in series an artificial line representing the cable, and putting beyond the artificial line an impedance network simulating the impedance of a long line, which might be in this case merely a resistance in series with a condenser.

If a line has many irregularities, however, the setting up of a balancing network, while always theoretically possible, would become very expensive and inconvenient. A fundamental requirement, then, in obtaining good repeater action on a line is the maintenance of a high degree of uniformity in the electrical characteristics of the line.

In this particular case the irregularity caused by the cable can, to a considerable extent, be overcome by inserting in the cable one or more loading coils to make the impedance of the cable approximately that of

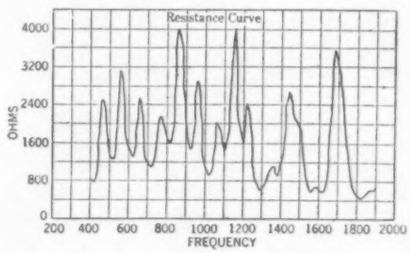


Fig. 36—Section of Transcontinental Circuit Pittsburgh to New York Before "Clearing Up"

the open wire line. In this actual case a single coil was cut into the cable near its mid-point, and the measured impedance after this had been done is indicated in Fig. 35. In this figure the curves after loading are shown in heavy lines and the old curves are indicated in lighter lines for comparison.

In the case of loaded lines the problem of maintaining sufficient regularity in the electrical characteristics to give a satisfactory impedance curve becomes considerably more difficult, due to variations in the inductances of the loading coils and in the distances between these coils. To illustrate this a number of impedance curves of loaded circuits will be given showing the effects of their irregularities on the impedance characteristics. In these curves, for simplicity, only the resistance component will be shown, as the reactive component is considerably smaller and goes through about the same irregularities as does the resistance curve.

Fig. 36 shows an impedance characteristic of an open wire line loaded at approximately 8-mile intervals with loading coils having approximately ¼ henry each. This circuit would give commercial service from a transmission standpoint. It will be noted, however, that its impedance

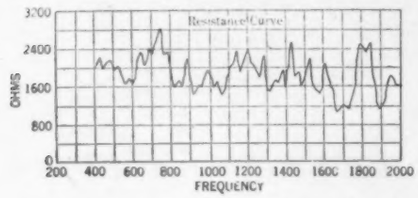


Fig. 37—Section of Transcontinental Circuit Pittsburgh to Chicago Before "Clearing Up"

characteristic is extremely irregular, and it would be difficult to obtain gains from a telephone repeater operated in conjunction with it.

Fig. 37 shows the resistance of a circuit if similar constants representing a less extreme condition of irregularity. This would have been considered, before the advent of repeaters, a reasonably good circuit so far as irregularity is concerned. These irregularities were due largely to comparatively small variations in spacing of loading coils and in the inductances of the loading coals. Loading coils have to be placed on a telephone circuit at particular points in the transposition layout of the circuit in order to prevent crosstalk between it and other circuits on the same lead. It is difficult, however, exactly to space transpositions in view of the variations in the route taken by a line, lengths of cable, junction points with other lines, etc. This led in the past to variations in the lengths between the successive loading points. Aerial loading coils are exposed to current surges due to lightning, and with some of the types of coils which have been put into use this has led to variations in their inductances. For any given frequency it may be that the effect of a large number of such irregularities are cumulative in raising the impedance of the circuit for that frequency, whereas with another frequency only slightly removed from the first, the effect of the irregularities may be to reduce the impedance. The result then with such impedance is indicated in Fig. 37 where the variation was due not to a few large irregularities, but to a large number of small irregularities.

This particular circuit was one of those entering into the transcontinental line, so that it was very carefully gone over, retransposed where necessary, the loading coils replaced by others having a particularly high degree of stability and uniformity and the spacings made very uniform. The result of this work is indicated in Fig. 38 in which the dark line shows the impedance after this work had been done and the light line is a repetition of Fig. 37 for comparison. The circuit will now permit of large gains with repeaters.

In the cases where a large variation in impedance is due to one or more large irregularities, the impedance curves often offer a very interesting and convenient method of determining the point at which irregularity exists. For example: Fig. 39 shows the impedance of a circuit as measured from one end, the large wave-like variation being due to defective apparatus at some point in the circuit. By measuring the frequency range between successive "humps" on this "wave" it is possible to determine the distance from the sending end to the point of irregularity. In practical work many cases have arisen where omitted or defective coils or other irregularities have been located in position by this method.

In maintaining this uniformity of the characteristics of the line, one of the largest difficulties is caring for short lengths of cable which may occur in the line at river crossings, in going through towns, etc. It has sometimes been difficult to explain to those outside of the telephone field, but who are acquainted with the fact that by loading and telephone repeaters we can talk through long lengths of cable, why it is that we have so much difficulty with short lengths of cable which come into our open wire circuits, and why we are averse to cutting such short lengths into important long distance lines at villages and at crossings of railroads, power lines, etc. Considering, however, that a 500-ft. length of cable has as much capacity as three-quarters of a mile of open wire, it is evident that even a short length of cable has a very large effect on the operation of any repeater on the line. In laying out a circuit, such short lengths of cable can be partially corrected for in the spacing of the loading coils. Changes made after a line is laid out are of course much more difficult to take care of.

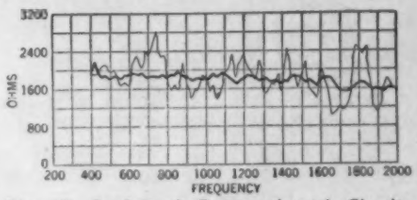


Fig. 38—Section of Transcontinental Circuit—Pittsburgh to Chicago After "Clearing Up"

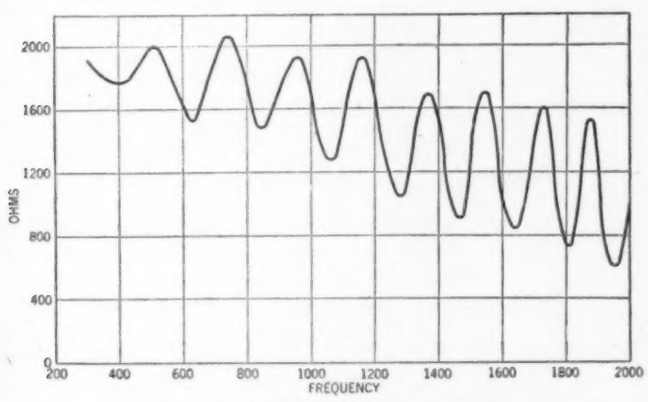


Fig. 39—Loaded No. 8 Gage Open Wire Line.
Note: This irregularity was caused by defective apparatus located at a distance of about 15 sections from terminals at which meassurements were made.

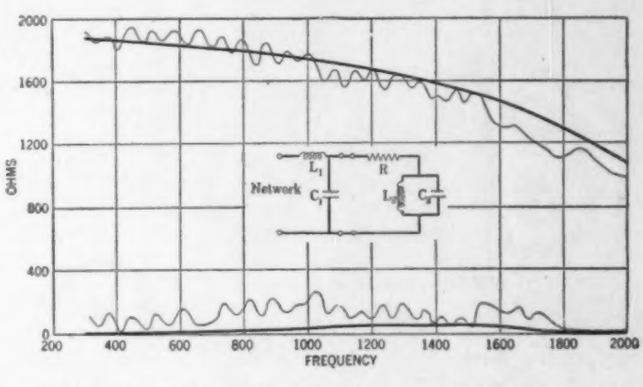


Fig. 40—Loaded No. 8 Open Wire Line 1/2 Coil Termination.

In cable circuits the problem of maintaining uniformity is similar to that of open wire lines, requiring very

accurate spacing of the loading coils and requiring loading coils of very uniform characteristics and of high electrical stability.

BALANCING ARTIFICIAL LINES

Assuming, then, in any case, that the lines have been made as uniform electrically as is economical, there is the problem of constructing artificial lines (or networks, as they are generally called) which shall have within a desired degree the same impedance as the actual line. It should be noted that these artificial lines do not need to have transmission characteristics corresponding to the actual lines, but need to have only the same impedance characteristics.

A very simple form is that indicated above for use in balancing a non-loaded open wire line, consisting of a single resistance in series with a single capacity. As already noted, a better approximation for a non-loaded open wire line can be made by adding another resistance and condenser as shown in Fig. 32.

For loaded lines, it is necessary to use a somewhat more complex artificial line, although here again the basic form is comparatively simple. Fig. 40 shows in light lines for comparison an impedance curve much like that of Fig. 38, and in heavier lines, the impedance of an artificial line consisting of two condensers, a resistance and two inductance coils arranged as indicated by the diagram in this figure. For completeness both the resistance and reactance of the impedance are shown in the figure.

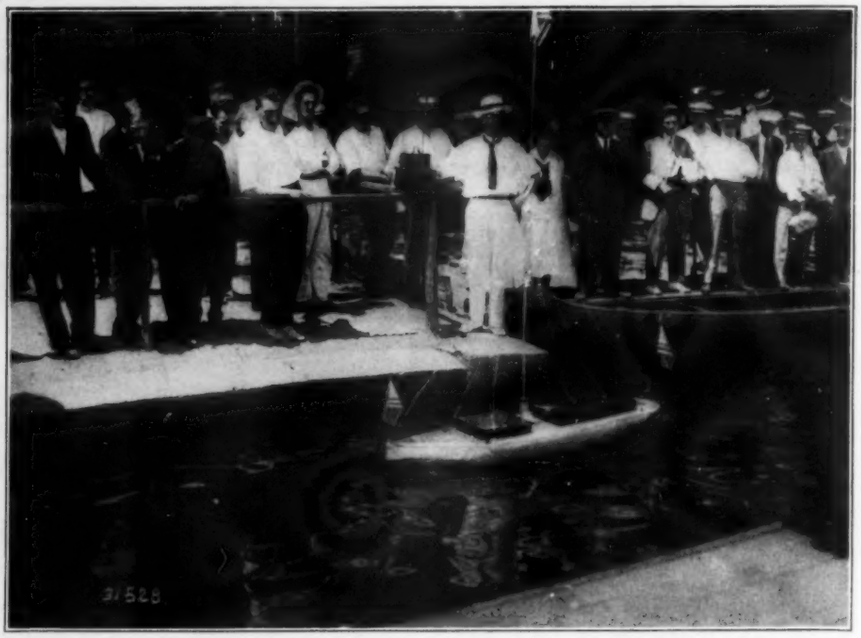
In the case of a loaded line the impedance depends very markedly on the place in the loading section from which the circuit is measured. In practise lines are generally terminated either at mid-section or at mid-coil, since these points are symmetrical points in the loading and make for maximum flexibility in connecting circuits together. Most of the figures in this paper were taken at mid-coil.

It is evidently necessary that the balancing line should balance not only the actual line itself, but any apparatus between the line and the point at which the repeater is applied, so that all coils, composite sets or other devices used in series with the line must be with the necessary precision, balanced in the artificial lines by corresponding coils, condensers, etc.

(To be continued)

Wireless Forest Telephones a Success

The wireless telephone, as a result of a season's tryout, during which the handicaps of "packing" instruments over a 30-mile mountainous trail, the perils of passing through a forest fire and numerous other tests were applied, has been pronounced a success for forest service work by officials of the service according to an announcement from district headquarters at Missoula, Mont.



Professor B. K. Shepard of Medford, Mass., a member of the faculty of Tufts College, steering a small boat from shore by means of a new wireless apparatus which he has invented. The instrument can also be made to ring bells, fire a small cannon, blow horns, steer an auto and perform other tricks. Professor Shepard is now working on a wireless submarine destroyer to be operated from a small boat at sea. In case the torpedo misses its mark it can be steered back to the sender. The new invention has no ground wire, as in the Hammond patents, and can be carried and operated by hand.

Hereafter, the announcement says, wireless telephone instruments are to be a part of the standard equipment of the forest service.

At the direction of Chief Forester William S. Graves, tests of this plan of communication were initiated in this district last season by R. B. Adams, telephone engineer, who was assisted by Everett Cutting. United States signal corps standard sets were selected for the experiment, and one was placed in position, after almost interminable difficulties, at the Mud Creek ranger station, near the Lola Hot Springs, Mont., and another at Beaver Ridge, Idaho.

While the air-line distance between the two stations is but 12 miles, the distance by trail is 30 miles, much of it almost impassable even with pack animals. At last, however, after mishaps that included pack horses off the trail, packs displaced and rolling down mountainsides, and batteries and equipment all but lost, the antennae were hung high on convenient pines.

"The sets were used during the fire season of 1919 in reporting fires and otherwise in the carrying on of the fire campaign with eminently satisfactory results," says the forest service statement.

The real test came during the destructive forest fires in the Clearwater forest in northern Idaho.

"Over 90 miles of ordinary telephone line was destroyed," the statement says. "The trees from which the wire was suspended were burned. Telephone communication was thus ended and the efficiency of the fire-fighting organization correspondingly reduced. It took over a week to restore this communication."

In marked contrast was the effect of fires sweeping near wireless stations. With the flames dangerously near the Beaver Ridge station the operator promptly transferred the entire equipment to a hastily constructed log raft which he had put afloat on a near-by lake, navigated to a safe distance from shore and awaited the passing of the fire. After the front had passed he returned to shore, set up his equipment and within an hour was making a report of the cause of the interruption to communication.

Because the name was not listed in the telephone directories of Morgantown, W. Va., the Davis Coal Company obtained an injunction restraining the telephone company from circulating the new books or collecting the old ones.

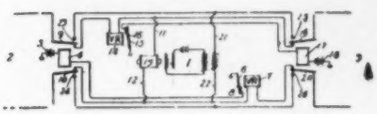
Telephone Patents Recently Issued

A Brief Digest of the Most Interesting Current Specifications

By DAVID S. HULFISH

NO. 1,324,202. Ringing system. Issued to T. G. Martin, assignor to Automatic Electric Company, Chicago, Ill. (Original application field January 3, 1911.) The central office automatic switches have the customary automatic ringing equipment. In addition, a key is provided at the calling telephone which, when pressed manually, will ring again upon the called line.

1,324,355. Ringing system. Issued to C. W. Keckler, assignor to Western Electric Company, Inc.,



1,326,199.

New York, N. Y. For a manual switchboard. The cord pair equipment has no manual ringing key. Ringing is done by a relay which is operated to begin ringing as soon as the ringing plug is inserted into the jack of the called line.

1,324,356. Calling Device. Issued to J. A. Kropp, assignor to Western Electric Company, Inc., New York, N. Y. A callsender for automatic telephones is built to encircle the funnel of the transmitter.

1,324,357. Transmitter. Issued to H. A. Larlee, assignor to Western Electric Company, Inc., New York, N. Y. In a carbon sell, a particular arrangement of parts for clamping the front electrode and its diaphragm to the walls of the cell is provided, giving great flexibility.

1,325,401. Automatic Switch. Issued to A. C. Magrath, assignor to Western Electric Company, Inc., New York, N. Y. The brushes are propelled by a spring and are controlled in their steps by an electric magnetic escapement. The power of the spring is restored constantly by a motor acting through a clutch to a ratchet wheel.

1,324,749. Clearing-Out System. Issued to F. M. Slough, assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. In a cord pair for manual switchboard the disconnection is made automatically by relays when a telephone is hung up. In this patent, a delaying mechanism is provided, giving time for both parties to hang up, thus avoiding the lighting of a line lamp unintentionally.

1,324,750. Automatic Switching System. Issued to F. M. Slough, assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. The actual connection of two lines is effected by relay contacts, several relays being provided and the proper relay being selected by a stepping switch at the central office.

1,324,796. Keyless Cord Pair. Issued to L. W. Carroll, assignor to Western Electric Company, Inc., New York, N. Y. A feature of automatic ringing is found in the control of the ringing relay. One receiver off hook brings it to half charge and rings the other line; two receivers off hook brings it to full charge and stops the ringing.

1,324,847. Automatic Switch. Issued to O. E. Rasmussen, assignor to Western Electric Company, Inc., New York, N. Y. In this improved switch, the shaft which carries the wipers has three movements, successively, all of the movements being controlled by a single controlling magnet.

1,325,878. Receiver Diaphragm. Issued to Alexander Marr, Longsight, England. The receiver diaphragm is clamped in the case by a ring of sharp edges or points, instead of by two flat ring surfaces. A greater sensitiveness is claimed.

1,326,199. Repeater Circuit. Issued to E. D. Johnson, assignor to Western Electric Company, Inc., New York, N. Y. A difficulty in operating the voice repeater is the tendency of the repeater to produce an audible tone by reacting upon itself. This patent provides a repeater arrangement which does not react upon itself. The input side of the repeater is connected to both lines in both directions, the output side being open. A relay sensitive to voice currents operates when one of the lines speaks, causing the remaining line to be switched from the input side to the output side of the repeater, the repeater thus becoming temporarily a one-way, non-reacting device.

1,327,500. Telephone Set. Issued to Henry Symes, Dunedin, New Zealand. The telephone set is of the hand-microphone type, with the addition of a callsender for automatic tele-

1,327,500.

phone exchanges. The callsender is attached to the hand set at the cord end of the handle, opposite to the receiver of the set.

1,327,622. Callsender. Issued to F. A. Lundquist, assignor to Casper L. Redfield, trustee, Chicago, Ill. In a button-bank callsender for central office use, the keys have a pneumatic device associated with them which operates to give the proper electrical impulses in response to the depression of the numerical keys.

Indiana Bell Companies Consolidate

A consolidation of all the Bell telephone property in Indiana was completed with the filing of articles of incorporation with the secretary of state for the Indiana Bell Telephone Company with a capital stock of $15,000,000. The offices of the company will be in Indianapolis.

The companies included in the new corporation are the Central Union Telephone Company, which has its main offices in Indianapolis; the Southern Telephone Company, which

operates in thirteen counties in southern Indiana; the United Telephone Company, which operates in Blackford, Wells, Grant and Huntington counties; the Citizens Telephone Company of Kokomo, and the Indiana Union Telephone and Telegraph Company, which operates an exchange at Fowler.

The following are given as incorporators: Frank Wampler, Indianapolis; C. H. Brownell, Peru, Ind.; D. H. Whitman, Indianapolis; C. A. Breece, Bluffton, Ind.; George G. Hall, Evansville, Ind.; Theodore N. Vail, Lynnville, Vt.; H. B. Thayer, New Cameron, Conn.; Eugene S. Wilson, Highland Park, Ill., and Edgar S. Bloom, Chicago.

The company made the following formal announcement:

"The Indiana Bell Telephone Company, which will have its general offices at Indianapolis, has been organized under the laws of the state of Indiana, with a capital stock of $15,000,000, for the purpose of placing the properties of the Central Union Telephone Company in the state of Indiana, and such other properties comprising part of the Bell system in the state of Indiana, under the explicit jurisdiction of the public service commission of Indiana, and to effectuate a single ownership and operation of such properties.

"It is expected the carrying out of the plan will promote simplicity and economy of operation and will be for the best interest of the subscribers of the Bell system throughout Indiana. In addition to the Central Union Company the new company will take over the properties of the Southern Telephone Company of Indiana, which operates in thirteen counties in southern Indiana; the United Telephone Company, which operates in Blackford, Wells, Grant and Huntington counties; the Citizens' Telephone Company of Kokomo, which operates an exchange at Kokomo, and the Indiana Union Telephone and Telegraph Company, which operates an exchange at Fowler. It is expected within a few days the entire plan will be submitted to the public service commission of Indiana for its approval."

No announcement was made as to the officers of the new company.

There were 233 American women serving as telephone operators in American Expeditionary Forces in France during the war, it is reported by the chief signal officer of the army. They had charge of telephones in the larger central stations.

Says Public is Largely to Blame

A request that the public do away with all unnecessary telephone calls and be tolerant of the service has been made by the Memphis, Tenn., Chamber of Commerce in connection with the report of J. N. Cadby, expert who made a survey of the telephone situation in Memphis. This request was made in connection with the recommendation that the Cumberland Telephone & Telegraph Company be given 60 days to bring the local service up to standard before appealing to the public utilities commission.

Mr. Cadby reported that irritability by the public made the service worse, and, in truth, that tolerance would go a long way toward mending the faults found with the service.

This idea was elaborated upon in the report of the Chamber of Commerce committee which used Mr. Cadby's report.

"While it is our opinion," runs the report, "that it is in the power of the telephone company to remedy the present service, and that its failure to do so should in no sense be palliated or excused, yet your committee is of the opinion that nothing is to be gained by exaggerated or unjustified criticism of the company.

"For example, Mr. Cadby, at request of your committee, investigated the alleged failure of telephone service during the recent fire at the Gayoso Hotel. He reports that both the manager and telephone operator state that there was no failure of telephone service and that they have no criticism to make in regard to same.

"It should especially be borne in mind that petulance, impatience and discourtesy exhibited towards the individual telephone operator result only in harm. She is usually rendering the best service she can. The break-down is caused by the fact that she has not had opportunity to receive adequate training, or that the company has not furnished sufficient help for her.

"Impatience and criticism merely tend to make her dissatisfied and to render more difficult the task of the company in retaining its present force of operators and in obtaining additions thereto. On the other hand, courtesy, patience and co-operation, especially along the lines indicated by the questionnaires, will, we believe, materially aid in bettering the service."

An appeal to the public is made in the following:

"It would, perhaps, not be helpful to attempt to analyze the reason for the shortage of operators in the past. It is undoubtedly true that the telephone company, along with many other industries, has suffered in this respect as a result of the abnormal conditions which prevailed during and have prevailed since the war. Your committee also finds that the telephone company has made and is making efforts to increase its force of operators, and the conditions under which these operators work are clean, wholesome and comfortable.

"The company is especially to be commented for the consideration shown its operators in the way of clean and sanitary surroundings, such as an emergency hospital, well arranged and well furnished rest rooms, and a cheap and sanitary lunch room. It is believed that if the favorable conditions under which these operators work were better understood there would be less difficulty in obtaining their services. It is also true that the company has advertised, and is advertising, for operators and is making a house to house canvass for the purpose of securing them. While these efforts deserve recognition, yet it is the opinion of your committee that they are not sufficient to lift from the company the responsibility for this shortage of operators."

Cheap Wireless Talk Across Ocean

Signor Marconi prophesies that in the immediate future conversations between Great Britain and the United States will be carried on by wireless telephones and that the price will not be more than 14 cents for one minute.

The great inventor said that he spoke direct to Canada from London and he added:

"It is only a matter of time when we shall be able to talk to New York from London. Already we have carried out many successful experiments between London and the Continent, and we hope that we shall be able soon to announce the installation of a world-wide wireless telephone system in all countries interested. Our plans are developing rapidly."

Transoceanic conversations will be carried on through an ordinary telephone, the exchange being connected with the wireless stations at the receiving end and the same methods will be followed.

Signor Marconi already has applied for permission to erect a station in Norway to demonstrate his ability to talk across large expanses of water.

Public Utility Commission News

Reports Concerning the Activities of State Authorities in the Telephone Field

Arkansas

A SETTLEMENT of the controversy between the Cane Hill and Stilwell Telephone Company of near Booneville and the subscribers was effected, when the case was called before Walter G. Brasher, representing the Arkansas Corporation Commission. S. R. Grounds, owner of the system, had applied to the commission for a permit to increase the rates from 25 cents to 40 cents per month. The subscribers objected. When the case was called, Mr. Grounds offered to sell his system to the subscribers, and pay them 40 cents per month for his telephone. Twenty subscribers announced they were ready to accept Mr. Grounds' proposition, and a deal soon was consummated. The commission dismissed the case.

Illinois

The Murphysboro Telephone Company was ordered by the state utilities commission to take steps at once to provide adequate, prompt, continuous and effective service in Carbondale and surrounding communities. The company was ordered to report to the commission in Springfield on March 2 what measures it had taken to comply with the orders.

The commission had a hearing in January as to a petition to increase rates, and conducted hearings in Murphysboro January 16 and February 2 in connection with the proposed rate increase. The commission granted the company a temporary rate increase in December.

One will be held in Marion on Thursday, March 18, and at that time the patrons of the exchanges in Marion, Herrin, Johnston City, Carterville, Creal Springs, Pittsburg and Cambria are invited to appear and explain the situation to the representative of the state board. On the next day, Friday, March 19, a hearing will be held in Benton for Franklin county subscribers.

The Public Utilities Commission resuspended until June 18 proposed telephone rates for nine cities.

C. J. Johnson, of the Paxton Telephone Company, in speaking of the new telephone rates which the company expects to collect, with the permission of the state utilities commission, stated that the charge for a business telephone will be $36 a year and for a residence telephone the charge will be $24. The present rate is $24 for business and $18 per year for residence. He further said that the company when the change is made expects to erect a fire-proof building and install modern equipment which will insure the best of service.

The State Public Utilities Commission has recently authorized the following rates to be charged for telephone service at Carlinville and Litchfield:

Carlinville.

	Gross rates month	Net rate
Private line, bus. serv.	$3.50	$3.25
Two party line, bus. serv.	3.00	2.75
Private line, res. serv.	2.50	2.25
Two party line, res. serv.	2.00	1.75
Four party line, res. serv.	1.75	1.50
Rural party line, res. serv.	2.00	1.75

Litchfield.

	Gross rates month	Net rate
Private line, bus. serv.	$3.25	$3.00
Two party line, bus. serv.	2.75	2.50
Private line, res. serv.	2.50	2.25
Two party line, res. serv.	2.00	1.75
Four party line, res. serv.	1.50	1.25
Rural party line, res. serv.	2.25	2.00

A toll rate of 10 cents for five minutes' conversation was placed in effect February 1st, 1920, between Carlinville and Chesterfield, Ill.

Indiana

The Public Service Commission authorized the consolidation of the Farmers Mutual Telephone Company of Vevay, the Sugar Branch Telephone Company and the Moorefield Telephone Company. The new company will be known as the Farmers Mutual Telephone Company of Vevay.

The Jennings County Telephone Company was authorized to increase its exchange rates. The new primary rates are: Individual business, $2.50 net; individual residence, $2 net; business party line, $2 net; residence party line, $1.50 net; and party line rural, $1.25 and $1.50.

The public service commission has authorized the Flint-Kyle Telephone Company, of Daviess county, to increase telephone rates in Montgomery on single line business telephones from $1.25 to $2 net a month, single line residence from $1.25 to $1.50 net and party line, residence or rural, from $1 to $1.75 net. In Epsom the single line business telephones are to be increased from $1.25 to $2 net a month and party lines from $1 to $1.25 net. Bills are net if paid by the 15th of the month for which service is charged. If paid later they are gross and the gross charges are 25 cents higher.

The Pike County Telephone Company was authorized to continue in effect the rates established by the federal wire administration. They provide for a charge of $3 for single line business telephones; $2.50 for party line business telephones; $2 for single line residence telephones; $1.50 for party line residence telephones; $2.25 for rural party line business telephones, and $1.75 for rural party line residence telephones.

The public service commission suspended the 10-cent toll rate it authorized the Waldron Telephone Company to put into effect for service through the Waldron exchange to Shelbyville. The rate was established some time ago, but on vigorous protest from some of the patrons of the small company the commission suspended the rate to see how the company can get along without the proposed revenue from that source.

The public service commission has granted the petition of the Mellott Telephone Company to raise rates and the following rates per month went into effect:

Business, single line, $1.60 gross, $1.50 net.

Business, party line, $1.50 gross, $1.35 net.

Residence, single line, $1.45 gross, $1.35 net.

Residence, party line, town or rural, $1.35 gross, $1.25 net.

For each additional ¼ mile a line charge of 25 cents shall be added. All rates are payable quarterly in advance.

Every subscriber owning his own instrument and line shall have a rebate of 25 cents per month.

The same rates and conditions were

also granted for the Newtown Telephone Company by the commission.

The Crown Point Telephone Company has petitioned the Public Service Commission of Indiana asking that the provision of the commission order covering the use and investment of the depreciation fund, be suspended until further order of the commission, which has been temporarily suspended as prayed for.

The commission ordered that petitioner, the Crown Point Telephone Company, shall pay into a depreciation fund the moneys provided for depreciation, which fund shall be held separate and handled with proper accounting; that there shall be paid out of this fund all costs of meeting depreciation. Money so accumulating in said fund should be invested and if invested, such investment shall be made in government or other high grade listed securities which shall return to said fund not less than four per cent interest per annum; or petitioner may borrow from this fund, for a period of not to exceed one year, money to cover not more than seventy-five per cent of the cost of new construction, extensions or additions to the property items properly chargeable to capital account—but, in such event, petitioner shall pledge to such fund its own note or bonds bearing interest at the rate of not less than four per cent per annum. Such moneys so borrowed by petitioner shall be repaid in full within one year. In handling such fund, petitioner will be held strictly accountable for its safe investment, proper administration and accounting. Said accounting shall be kept double entry with the asset account designated as "depreciation fund" and the liability account designated as "depreciation reserve."

The Public Service Commission has authorized the Citizens' Telephone Company of Cambridge City to establish an increased schedule of exchange rates in Cambridge City, Hagerstown, Losantville and Blountsville.

The commission fixes the value of the property at $140,000 and estimates that the new rates will produce revenue to give a 3.7 per cent return on the investment.

The new net rates for Cambridge City are: Business single, $2.25; residence single, $1.50; four-party business, $1.75; four-party residence, $1.50; rural business party line, $1.75, and rural residence party line, $1.50.

The new net rates for Hagerstown are: Business single, $2.15; and other classes of service, $1.50, with the exception of party line business and rural business, which will have a rate of $1.75.

In Losantville business single is $1.50 and other classes of service $1.25. In Blountsville the rates are: Business single, $1.50; party line residence (town), $1.15, and other classes of service, $1.25. All single-line service rates are base rates and are subject to a line charge of 25 cents for each quarter of a mile.

The Public Service Commission has authorized the Citizens Telephone Company of Cambridge City to establish an increased schedule of exchange rates in Cambridge City, Hagerstown, Losantville and Blountsville. The commission fixes the value of the property at $140,000 and estimates that the new rates will produce revenue to give a 3.7 per cent return on the investment. The new net rates for Cambridge City are: Business single, $2.25; residence single, $1.50; four-party business, $1.75; four-party residence, $1.50; rural business party line, $1.75, and rural residence party line, $1.50. The new net rates for Hagerstown are: Business single, $2.25; and other classes of service, $1.50, with the exception of party line business and rural business, which will have a rate of $1.75. In Losantville business single is $1.50 and other classes of service $1.25. In Blountsville the rates are: Business single, $1.50; party line residence (town), $1.15, and other classes of service, $1.25. All single line service rates are base rates and are subject to a line charge of 25 cents for each quarter of a mile the subscriber lives beyond the corporate limits. Gross rates 15 and 25 cents higher than the net rates are provided for failure to pay bills promptly.

The commission authorized the Liberty Telephone Company to increase its telephone rates to enable it to earn 3.2 per cent return on a tentative valuation of $82,000. The new primary net rates are $2.25 for business and $1.50 for home telephones with the same rates for rural telephones plus 25 cents for each one-half mile from the exchange.

Seven hundred rural telephone subscribers in Jackson county have threatened to have their telephones disconnected from the exchange in Seymour in protest against an order of the Indiana public service commission which increases the switchboard rate from 25 cents to $3 a year.

The telephones are operated by twelve Independent mutual companies, which have connection service with the exchange. The commission ordered that the increase must be paid or a toll service established. The 25-cent rate was put into effect at the time that the Seymour Mutual Telephone Company was organized by local business men.

The Waldron Telephone Company, operating a telephone system at Waldron, Shelby county, and owned by Roy Jones, has received permission from the Indiana public service commission to increase its rates to $2 a month for business telephones, and $1.50 a month for residence telephones.

The public service commission has authorized the Mooreland Rural Telephone Company to issue and sell at not less than par, seventy-six shares of $100 each of its capital stock, the proceeds to be used for the purpose of reimbursing its treasury for expenditures heretofore made for additions and betterments.

The hearing before the commission was held on January 2 and the evidence showed the telephone company has an authorized capital stock of $20,000 in 200 shares of $100 each. Seventy-six shares of the stock have been sold and are now outstanding and the remainder is held in the treasury of the company. The value of the property was shown to be $20,000.

At the hearing it was shown that the company has recently expended more than $7,600 for improvements and the petition was for the purpose of partially reimbursing the treasury for such expenditures. The case was heard by Commissioner Glenn Van Auken and in the order Commissioners McCardle and Johnson concur.

The commission has authorized the Citizens' Telephone Company, Macy, to buy the Fulton Telephone Company for $9,000 and to establish a new private line rate of $1.45 net a month and of $1.25 a month for party lines.

Colorado

Decrees of the Colorado supreme court denying jurisdiction of the state public utilities commission over telephone rates within the city of Denver, will stand, the supreme court of the United States dismissing for lack of jurisdiction appeals brought by the Mountain States Telephone and Telegraph Company.

Michigan

While the Michigan public utilities commission gave no intimation as to what action it would take on the application of the Michigan State Telephone Company for an increase in its present temporary rates, the willingness of the commission to grant increased rates to utilities on proper showing was made plain.

"We are not afraid to inform the public that the commission will have no hesitancy in giving a higher or lower rate of return to utilities, based on the kind of service they render, and not so much on any arbitrary basis, said Chairman W. M. Smith at the conclusion of the hearing.

"For this reason, we would give some companies as much as 7 per cent, while in other cases 3 might be more than was earned. Michigan is probably the most rapidly growing state in the country. That growth, and the development of its industries, together with the prosperity of its towns and cities, are dependent in these times to a very material extent on good telephone service. It is not the fact that the Michigan State Telephone company has millions of dollars invested in this state, that it is entitled to any return; it should be the service given with that invested capital which should determine the return up to a fair maximum."

On the basis of the company's figures submitted in evidence at the hearing, as to its present deficit, it is being deprived of $2,500,000, of which $1,500,000 is credited to Detroit, and the remaining $1,000,000 to the state. This includes the payment of 4.5 per cent on gross return to the American Telephone & Telegraph Company, and then a net return of 8 per cent, with six per cent set aside for depreciation.

Corporation Counsel Clarence E. Wilcox, of Detroit, by a readjustment of the company's own figures on a modified basis, showed that the return to the company for the four months from last August 1 to November 30 would amount to $429,000 instead of the $80,000, as claimed by the figures submitted.

"It is really a serious question whether or not on the present basis, the Michigan State Telephone Company is not now receiving a sufficient rate of return under any circumstances on its investment," said Mr. Wilcox.

In his computation he included the $80,000 which the company declared to be its net return for the four months' period. He then readjusted the 4.5 per cent paid on contract to the American Telephone and Telegraph Company by substituting the amount which Judge Wiest recently fixed on the basis of a reasonable rental of each telephone instrument. The 4.5 per cent amounted to $176,000 for the four months, the Wiest basis made it only $40,000, thus leaving $136,000 more to be credited to the return of the company.

The second adjustment made by Attorney Wilcox was in the depreciation reserve. He placed it at 3 instead of 6 per cent, which made $325,000 more to be added to return.

This method of calculation made the aggregate return to the company $541,000. Then he deducted from that amount the difference between 8 per cent as a return and 7 per cent, which he contended was sufficient—amounting to $112,000, thus leaving the company on a 7 per cent return basis $429,000 for the four months period.

The company's accountant admitted that if figured on the basis suggested by Attorney Wilcox, the net return to the company for the four months covered by the accounts presented would be 5.3 per cent

As to the 4.5 per cent paid to the American Telephone and Telegraph, Attorney Wilson, for the telephone company, stated that it was being loaned money by the parent concern at 6 per cent, when otherwise it would be compelled to pay 8, and this difference of 2 per cent should be offset against the 4.5 per cent.

Ten cities were represented at the hearing: Detroit, Kalamazoo, Grand Ledge, Traverse City, Menominee, Lansing, Battle Creek, Mt. Clemens, Saginaw and East Lansing.

Chairman Smith assured the representatives present that whatever the action taken now on the company's petition for an increase in rates, it would push forward the inventory and appraisal of its property over the state as rapidly as possible, with the view of beginning hearings on which to base a permanent rate as soon as time will permit.

The Michigan State Telephone Company has been ordered by the public utilities commission to bring all its books, records and accounts into the state to be accessible to the commission at all times. Some of these records are now kept in Chicago. The order follows an application of the company to issue new securities.

The Michigan public utilities commission has decided that a telephone company cannot monopolize a given territory without giving service, and it is taken as an indication that the commission will insist upon adequate service in all localities where mergers of existing companies are authorized.

As a result of the order signed by the utilities commission, the Lenawee County Telephone Company owned by the Michigan State Company through stocks and bonds, will be required to make connections and give long distance service through the Macon Telephone Company.

The Macon company, which is a farmers' mutual operating in Macon township, Lenawee county, operates within a radius of five miles from Clinton. The Lenawee county Telephone Company, which operates the exchange at Clinton, would not give long distance service between its office and the Macon Exchange and the farmers claimed this refusal seriously interfered with their business which is principally stock raising and shipping.

In its order the commission says:

"The only reason for the existence of a telephone company, aside from the question of making money, is to give service to the public. If a telephone company renders no service to the public it is not entitled to monopolize territory; to take away the right to service from those that are entitled to it.

"To refuse to grant relief to the Macon Telephone Company in this would put the seal of approval upon the exclusive monopoly of the Lenawee County Telephone Company, to this territory; put a premium upon failure to render reasonably adequate telephone service; and reward it for furnishing no telephone service at all in many instances."

Division of territory in the western part of the state, by which the Michigan State Telephone Company would acquire many exchanges now in competitive territory, is contemplated in a plan laid before the Michigan Public Utilities Commission by George M. Welch, general manager of the Michigan State, and C. E. Tarte, general manager of the Citizens' Telephone Company, Grand Rapids.

According to the arrangement between the companies the Citizens' corporation and its subsidiaries would sell to the Bell organization their exchanges in Lansing, Jackson, Marshall and Battle Creek. The territory retained by the Citizens' companies would center around Grand Rapids, running far enough north to include

Reed City, east to include Ionia and Lake Odessa, south to include Hasting and Holland, and along the Lake Shore to include Grand Haven. All Bell exchanges in this territory, along with the competing exchange in Grand Rapids, would go to the Citizens' Company. All the Citizens' exchanges outside it would go to the Bell.

The new Michigan public utilities commission is going on the theory that in addition to basing rates solely on the money invested, service should be taken into consideration. As a result subscribers will not be compelled to pay for service which they cannot get when the instrument is out of order.

Frank Howe, a farmer living out of Ypsilanti, is one of those to secure advantage recently of the commission's position. His telephone became useless. The Michigan State Telephone Company refused to give him a rebate on the month's bill. Then Mr. Howe proceeded to write a letter to the commission. In reply Commissioner W. W. Potter said:

"If your telephone went out of commission on November 29, you should have notified the telephone company to fix it. If they did nor fix it within a reasonable time, then they ought not to collect rental from you for a telephone which was not a telephone, and which could not be used."

He secured his rebate. Also, it is reported unofficially to the commission that the Ypsilanti agent for the Michigan State stated that any subscriber whose telephone is out of commission would be given the proper rebate if notification is given to the company of the interruption with the length of time the telephone is out of order.

Free telephone service between the Owosso and Corunna exchanges of the Union Telephone Company was resumed after the charging of a 10-cent toll for several months. The order of the Michigan utilities commission, restoring the former conditions, makes Owosso and Corunna one basic exchange area. Fred M. Crowe, president of the county association of farmers' clubs, said Monday that since the order of the utilities commission was dated January 1, he would insist that the tolls charged by the company since then be refunded.

Twenty dollars a year is the munificent salary paid to the secretary of the Okemos and Mason Telephone Company, it was revealed before the Michigan public utilities commission. Despite this low cost for personal service, the company is justified, the commission found, because of other increased costs, to raise telephone rates for 30 subscribers from $12 to $15 a year. Those who will pay the increased rates are persons whose instruments are owned and maintained by the company. Thirty-seven telephones are owned by the subscribers, who maintain them and are not to be called upon to pay the interested rate.

An order was issued by the Michigan public utilities commission fixing a temporary schedule of rates in several exchanges served by the Valley Home Telephone Company.

The new rates are classified as follows:

Group one—Gagetown and Owendale—Area rates: Business telephone, 1-party, per year, $24; residence telephone, 1-party, per year, $18; residence telephone, 2-party, per year, $17; residence telephone 4-party per year, $16; farm line telephone, within 6 miles of central office, per year, $17; farm line telephone, more than six miles from central office, per year, $19.

Group 2—Birch Run, Clio, Frankenmuth, Mayville, Otisville, Reese, Sebewaing, Unionville and Vassar.

Business Telephone — One-party, per year, $28; business telephone, 2-party, per year, $24.

Residence telephone—One-party, per year, $20; residence telephone, 2-party, per year, $18.50; residence telephone, 4-party, per year, $17.

Farm line telephone, within six miles of central office, per year, $18; farm line telephone, more than six miles from central office, per year, $20.

There are no towns or exchanges in group three, four and five, inclusive, operated by said Valley Home Telephone Company.

Group six, Bay City—Business telephone, 1-party, per year, $48; business telephone, 2-party, per year, $40; residence telephone, 1-party, per year, $30; residence telephone, 2-party, per year $27; residence telephone, 4-party, per year, $21; farm line telephone, within six miles of central office, per year $21; farm line telephone, more than six miles from central office, per year $24.

An effort to upset the telephone rates established in 183 municipalities served by the Michigan State Telephone Company by the temporary order the Michigan public utilities commission issued August 14 is embodied in a suit filed against the commission in the Ingham circuit court by the city of Menominee.

The petition asks to have the order set aside on the ground that no full and complete hearing was had before the temporary rates were put into effect. It sets forth the fact that the main testimony on which the order was based had been heard before the old Michigan railroad commission in a case founded on the application of the telephone company for rate increases in 182 municipalities not including Detroit, and that this testimony was presented before the government took charge of the telephone business.

Menominee also contends that it was not properly represented during the two-day hearing just previous to the issuance of the August 14 order. Its city attorney was not present, the petition declares, and the attorney general had no authority to represent the city.

In answer, prepared by William P. Potter, of the commission the commissioners contend that the temporary order was based on all the evidence that could be obtained at the time. They argue that the attorney general was authorized by a resolution and by an act of the 1919 legislature to intervene in the telephone controversy and to represent the interests of the public.

"Either our order is valid or it is invalid," the commissioners declare. "If it is valid this suit should be dismissed. If it is invalid the city of Menominee and other municipalities affected should pay to the telephone company the Burleson schedule of rates. Unless our order superseded those rates with the temporary schedule now in effect the Burleson rates were in force, under authority of congress, until December 1, 1919."

Missouri

A petition was filed in the Cole county circuit court before Judge Slate by the Bell Telephone Company asking for a writ of certiorari to issue and that the court review the decisions and orders of the public service commission in regard to telephone rates and charges and specially as regards installation and removal charges.

Judge Slate has issued an order requiring the telephone company to file a supersedeas bond for $100,000 to the effect that they will repay all charges collected in case a repayment is ordered. The telephone com-

pany is further ordered to keep a correct record of all funds collected, from whom and their address, and at the end of each month the telephone company is required to deposit this money with the Missouri Trust Company at Jefferson City, to remain there until the case is finally adjudicated.

On these conditions the telephone Company will be permitted to collect the Burleson rates until the court can review the whole case.

A hearing will be given and the whole case reviewed by the Cole county circuit court as soon as the records are made up, or within thirty days after the records are filed in the court. It is said that the records are the largest ever made up by the public service commission.

Under the above arrangement the local Bell Telephone Company will be permitted to charge $3.50 for installation charges and $1 for changing names in directory.

Ohio

Ohio telephone companies are rushing before the state utilities commission to secure increase in rates before the Robinson bill, which recently passed the legislature, becomes effectitive. The Central Union Telephone Company of Columbus filed new rate schedules.

Under the Robinson bill, which will become a law in the near future, before any utility can increase its rates it must first give public notice in the newspapers of its purpose to increase rates and then secure the approval of the utilities commission after a public hearing has been had. Under the present law the companies merely file their new proposed rates, and if no objection is raised the rates become binding and the commission has no authority to prevent their taking effect.

Having failed in its effort to secure an increase in its rates last December, the Central Union Telephone Company has renewed its attempt, by filing with the state public utilities commission a new schedule of rates for Columbus to become effective March 1. The company filed in addition to the new schedule, a statement showing the annual revenues, expenses and net income of the Columbus exchange, based upon actual records for the five months from July 1 to November 20, 1919.

"The new rates are necessary because of the increased cost of furnishing service," said E. A. Reed, general manager of the company "and to aid the company in obtaining money to provide the extentions necessary to meet the demands of the public for additional facilities."

Reed indicated that notwithstanding the increases in exchange rates during the past two years, increases in revenues in Ohio from 1915 to 1918 was less than increases in expenses, due chiefly to increases in wages to employes.

Proposed increases are as follows: $1 a month in the rate for individual line business service, 50 cents a month for two-party line business service, and 25 cents a month in the business extension telephones, private branch exchange stations and all classes of residence service.

The minimum rate for measured service remains the same, but the number of calls permissible under that rate has been increased from fifty to sixty calls a month and the rate for excess messages has been reduced from 4 to 3 cents a message.

The suit begun by the city against the company three years ago is still pending and City Attorney Scarlett is preparing for the next hearing to be held before the Utilities Commission, at which officials of the company will be cross-examined. The commission is to decide the value of company property in Columbus, upon which a rate is to be established by the commission, giving the company a fair return upon its investment.

The company also filed new schedules, involving rate increases in Toledo, Akron, Springfield, Dayton and Sandusky.

The state public utilities commission ruled that Burleson telephone rates of the Ohio State Telephone Company would remain in force for Toledo. The company recently filed a schedule for increased rates with the commission.

Telephone rates in Cleveland were increased by the Ohio State Telephone Company. The new schedule approved by the state public utilities commission, provides for an increase of $1 a month for business telephones and 50 cents a month for residence telephones. The yearly rates are: Business telephones, flat service, independent line, increased from $84 to $96; two-party line, from $60 to $72; four-party line, from $48 to $60.

Business telephones, measured service, independent line, increased from $49 to $60; two-party line, from $42 to $56; four-party line, from $30 to $42.

Residence telephones, flat service, independent line, increased from $51 to $60; two-party line, from $27 to $30.

Residence telephones, measured service, independent line, increased from $36 to $42; two-party line, from $24 to $30; four-party line from $18 to $21.

Oklahoma

Salary increases, retroactive since September 31, last, were granted to the operators of the Southwestern Bell Telephone Company at Shawnee by the corporation commission which has had the case under advisement since October 29. The increase is said to bring the scale of wages equal to that received by the better paid operators in cities of the same class throughout the state.

Under the award student operators are to receive $10 a week the second month on local, and $10.50 a week on the boards. Operators who have served the company a year on September 13, and who have lost no time since then will receive approximately $17.50 each as backpay.

Wisconsin

A measured service plan has become effective in Milwaukee, by which subscribers of business telephones will pay $4 a month for 80 calls and three and one-half cents for each excess call up to 120 and two and one-half cents for succeeding ones.

That the company anticipated measured service would be allowed by the railroad rate commission is indicated by the admission of Frank M. McEniry, commercial superintendent that the necessary checking apparatus has been ready for use for some time.

Neighborhood stores, clubs and offices, which have been in the habit of permitting free use of the telephone put in hurry up calls for the nickel-in-the-slot device.

"There are sure to be some demands for nickel telephones," said Mr. McEniry, "but I am under the impression that most places where there is likely to be a demand for telephone service already have the slot device. Drug stores, department stores, hotels and saloons are all equipped.

"We do not look for confusion in putting the new system into effect. The apparatus has been installed for a considerable period because more than one-third of the business tele-

phones are already on measured service. I should say offhand that 2,900 out of 6,500 telephones today are under limited service.

"In registering the call the operator presses a button after it has been completed, and the call is imprinted on an automatic register."

Officials of the telephone company admitted they looked for an increase in revenue, but could not estimate the exact amount because the railroad commission had changed the schedule as submitted.

Minnesota

The Citizens Telephone Company of Mankato is permitted to purchase from the Tri-State Telephone and Telegraph Company, its local exchange properties located at Mankato, Madison Lake and Eagle Lake, Blue Earth County, reserving to the Tri-State Company such equipment and portions of the distributing plant as are required for toll line routes, together with such property as is not useful to the Mankato Citizens Company, as provided for in the contract entered into between the above parties January 2, 1920.

H. H. Tollefson, doing business at the Kasson & Mantorville Telephone Company is permitted to establish and place in effect, as of February 1, 1920, the following schedule of rates at Kasson and Mantorville, Minnesota:

	Per month gross
Individual line, business	$2.50
Individual line, residence	1.75
Two-party line, residence	1.50
	Net gross
Extension stations	$0.50
Rural multi-party, metallic	1.75
	Gross net
Rural multi-party, grounded	$1.50
Extension bells	.25

All gross rates to be payable monthly in advance with a discount of 25 cents per month if paid on or before the 15th day of the month in which the service is rendered, except that rural rates are payable quarterly in advance with a discount of 75 cents if paid on or before the 15th day of the first month of the quarter; a discount of 50 cents if paid on or before the 15th day of the second month of the quarter, and a discount of 25 cents if paid on or before the 15th day of the third month of the quarter in which the service is rendered.

The Norwood-Young America Telephone Company is permitted to purchase from the Carver Telephone Company and the O. C. Brunius Telephone Company all of the local exchange property and rural lines or other telephone properties owned by those companies as provided for in the contract entered into January 13, A. D., 1920.

The Effington Telephone Company is authorized to place in effect the following schedule of rates for telephone service at Urbank, Minnesota:

Individual line, business, $18 per year net; rural multi-party (company owned), $12 per year net.

Also to discontinue the present toll rate of 15 cents between Urbank and Parker's Prairie.

In the matter of the petition of residents of Prospect Park, Minneapolis, to prevent the Tri-State Telephone and Telegraph Company from discontinuing service from its St. Paul Midway exchange and omitting names of such subscribers from the Minneapolis directory.

It is ordered, that the complainants and the other subscribers of the Tri-State Telephone and Telegraph Company in this district in the city of Minneapolis, shall be listed in the St. Paul and Minneapolis portions of the directories issued by the company of its subscribers, and that the company is ordered to discontinue any proceedings to change or modify its exchange limits or service until such time as it has complied with the order of the commission, dated May 2, 1916. This order is issued without prejudice to the company for modification of its exchange areas, rules and regulations when properly presented to the commission.

The Armstrong Telephone Exchange Company is permitted to establish and place in effect, as of March 1, 1920, the following schedule of local and rural rates at Truman and Lewisville:

	Per month gross-
Individual line, business	$2.50
Individual line, residence	1.75
Rural multi-party, metallic	1.75
Rural multi-party, grounded	1.50
	Per month net
Lodges and halls	$0.75

All gross rates payable monthly in advance, with a discount of 25 cents per month, if paid on or before the 15th day of the month in which the service is rendered.

Arkansas Association Elects Officers

The annual meeting of the Arkansas Telephone Association terminated Jan. 27, after a two-day session. Fifty representatives of Independent telephone companies of the State attended.

This organization meets each year for the purpose of establishing cooperative methods, reviewing the work of the past year and to exchange ideas on improvements that may be adopted for the coming year.

Tuesday's program included the following addresses and discussions: "The Ideal Telephone Plant," by E. G. Greber, plant superintendent of the Southwestern Bell Telephone Company; "Determining the Handling of Traffic," by L. M. Higgins of the Texarkana of the Southwestern Bell Company; "The Satisfied Patron," by J. E. Armstrong of the Russellville Telephone Company; "The Satisfied Employes," by L. M. Higgins of the Texarkana Telephone Company, and "Why Independent Telephone Men Should Belong to the State and National Associations," by Thomas P. Stahl, Siloam Springs Telephone Company.

Wednesday's program was featured by the annual address of the president, L. M. Emmerson, of the England Telephone Company, who reviewed the work of the independent telephone companies. E. B. Sprague of the Corning Telephone Company discussed "Satisfactory Service and Adequate Rates;" William Graham of Clarendon made a short talk on "The Importance of Prompt Collections," and E. M. Frisby of Prescott spoke on "Rural Development."

The visitors were the guests of Riley B. Lane of the Southwestern Bell Telephone Company at dinner and later a theater party.

All the old officers were re-elected, as follows: President, L. M. Emmerson of England; first vice president, W. P. Ritchie of Stuttgart; second vice president, S. B. Wilson of Cotton Plant; secretary, Thomas Stahl of Siloam Springs; assistant secretary, Ernest Sowell of Little Rock; Executive Board, S. A. Lane of Little Rock, chairman; J. A. Womack of DeQueen, S. B. Sprague of Corning, L. E. Brasher of Greenwood and W. J. Savage of Hampden.

The association will hold a special meeting at the Arlington Hotel, Hot Springs, July 15 and 16.

Of Interest to the Trade

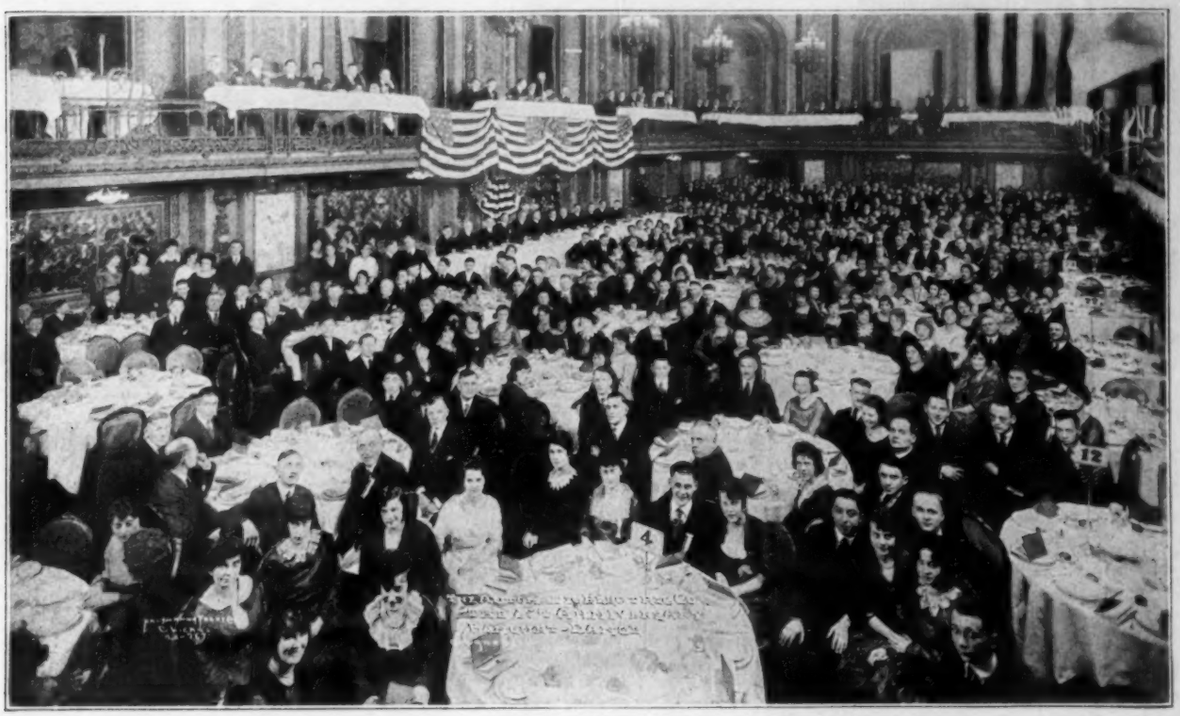
What the Telephone and Accessory Manufacturers are Doing to Advance the Art

28th Anniversary Banquet of Automatic Employes

Employes and officials of Automatic Electric Company held their 28th anniversary banquet at the Congress Hotel, Chicago, Saturday evening, February 7. In view of the very rapid expansion of Automatic Electric Company's organization to meet the constantly increasing demand for automatic telephone equipment, the number present was the largest in the history of these affairs.

H. D. Critchfield acted as toastmaster, and read a message of regret from Joseph Harris, chairman of the board of directors, who was confined to his home by illness. He also read telegrams from H. A. Harris, vice president and general manager, and H. L. Gary, vice president and treasurer, who were unavoidably absent. W. Lee Campbell, general superintendent, presented tokens of appreciation to members of the staff who had offered helpful suggestions as to ways of increasing the efficiency of the organization during the past year, and Grant Pelton, vice president in charge of operations, presented service pins to the employes who had been with the organization five years or more.

Although Joseph Harris and A. E. Keith had not yet completed 30 years of service in the automatic field, they were given 30 year pins, which are gold dials mounted with ten rubies and a diamond. Twenty-five year pins were presented to B. W. Johnson, Charles Erickson, John Erickson, and T. G. Martin. Twenty year pins were presented to W. Lee Campbell, T. E. Meyer and E. A. Mellinger. Fifteen year pins to Albert Anderson, R. A. Augustine, R. Bergendahl, Herman Bloss, R. H. Burfeind, John Coleman, P. H. Davenport, Lillian Dudenbostel, E. H. Engle, H. Geib, George Green, S. T. Gross, J. Henning, C. C. Hovland, F. Keuchenmeister, G. E. Lawson, E. R. Neir, W. E. Osborne, F. Porozynski, C. C. Rudolph, C. Shay, H. G. Strain, T. J. Truby, John Wicks, G. Anderson, B. Anis, Fred L. Baer, A. F. Bennett, Chas. Berner, W. R. Bishoff, Frank Borsom, S. M. Breeze, A. L. Carroll, A. Carlson, J. Croll, W. N. Curtis, Lillian Davis, D. Dorn, Harry Engle, James Engh, L. Erdman, John Forrest, R. C. Gifford, G. W. Gillette, C. A. Gregory, C. N. Griffin, C. T. Hayman, M. P. Heinz, G. Hiller, G. C. Hoagland, G. W. Irvine, W. E. Keeler, E. Kuchar, O. H. Larson, C. Mallerup, A. Mayer, H. F. Obergfell, S. G. Oftedahl, W. I. Patton, W. H. Perkins, R. Ramsey, Wm. Ross, L. G. Schwartz, O. C. Seemiller, C. E. Skyum, C. G. Stanelle, W. S. Think, T. C. Thompson, J. R. Turner, Roy G. Wheeler, L. Wilke, B. D. Willis, S. E. Witt and G. Yirsa.



Scene at the Automatic Electric Company Employes' and Officials' Annual Banquet.

More than three hundred ten and five year pins were presented.

Automatic Electric Company is to be congratulated upon having an organization containing so many individuals with such long and continuous training and experience in this specialized field, and with such a staff it is in a strong position to render expert service to its customers.

Standard Underground's Detroit Branch

The Detroit sales office of the Standard Underground Cable Company, which for several years has been a sub-office of the Chicago office, has been made a full branch office

R. E. Green

with R. E. Green in charge. Mr. Green has been in charge of the Detroit office since it was first opened. He has been connected with the Standard Underground Cable Company since 1909 as salesman, and is well known in this territory.

Convention Exhibitors at Atlanta

Exhibits of manufacturers and dealers occupied the ninth floor of the Piedmont Hotel in Atlanta, Ga., during the national convention, February 4 to 6. Without exception, the displays were well attended, and marked interest in them was shown by the visitors. Those exhibiting were:

Automatic Electric Company, Chicago, showing automatic switches and equipment for automatic exchange. Roy Owens and R. H. Burfeind were in attendance.

Barrett Company, Chicago, creosoting methods for poles. E. C. Mandenberg and E. S. Sanford represented the company.

Chance Manufacturing Company, Centralia, Mo., the "Never-Creep" anchor and pole-line hardware. J. J. Milligan and C. L. Clark were the men in charge.

Coffey System and Audit Company, Indianapolis, showed the company's accounting system, John W. Coffey doing the honors.

Cook Electric Company, Chicago, Showed samples of its line of telephone protective devices. George R. Folds, J. F. Japp and J. M. Moore were the representatives present.

Delco Light Company, Dayton, showed its small electric-lighting plant operated by gasoline, and similar plants for telephone exchanges. H. W. Meyers conducted the demonstrations.

Dixie Electric Equipment Company, Atlanta, telephone repair parts and rebuilt sets. Display of American Electric Company and Champion Carbon Manufacturing Company goods. C. W. Valentine and L. W. Sheldon in charge.

Edwards and Johnston, Indianapolis, telephone engineers. J. K. Johnston in attendance.

Electric Storage Battery Company, Philadelphia, storage cells and materials. D. O. Raffo handled the exhibit.

Electrical Instrument and Repair Company, Chicago, rebuilt magneto sets. Charles Nomec in charge.

Franco Electric Corporation, Brooklyn, telephone dry cells. J. M. Dimand and L. M. Sugarman in attendance.

French Battery and Carbon Company, Madison, Wis., telephone dry cells and flashlights. Frank L. Eldridge, J. C. Calhoun, J. R. Shue and S. H. Fowlkes represented the company.

Kellogg Switchboard and Supply Company, Chicago, displayed magneto and universal switchboards, P. B. X. boards, unbreakable desk sets, bakelite receivers, Kellogg transmitters, "grabophones," steel residence telephones, and a life-size photograph of a Kellogg service switchboard equipped with automatic ringing, instantaneous recall, instantaneous disconnect and automatic peg count. George D. Wolf, Glanton Smith, Claud Prueitt, Ben Woodbury, E. I. Pratt, Clyde Nelson and E. G. Reiss represented the company.

Leich Electric Company, Geno, Ill., showed magneto and common battery equipment, the Leich frequency converter and other ringing devices. W. A. Lankton was in charge.

National Carbon Company, Toledo, Columbia dry cells for telephone use. T. S. Stinson, Hamel Cheshire and R. W. Bennett were present.

North Electric Company, Galion, O., showed machine switching telephone parts. George W. Dickerson in attendance.

Reliable Electric Company, Chicago, protective equipment for switchboards, cables and telephone instruments. George W. Rodormer was in attendance.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, central energy and magneto equipment, No. 105 standard magneto switchboard. G. A. Scoville, W. T. Eastwood, J. M. Levis, A. V. Overshiner and J. M. Wilkinson were in charge.

Southern Electric Supply Company, Atlanta, was represented by C. D. Body and G. E. Fitzgerald.

Templeton, Kenly and Company, Chicago, showed a full line of pole jacks. T. E. Losey was in charge.

Auto Smashes Telephone Pole—It Retaliates

An automobile containing two farmers met with a curious accident at Lincoln, Ill.

The car was crossing the tracks going north when the steering mechanism became unmanageable and the machine crashed into a telephone pole standing near the crossing. The force of the impact snapped the pole off close to the ground and it fell on the top of the car, caving it in and smashing the windshield. The occupants of the car both in the front seat were uninjured and the damaged car was taken to a garage for repairs.

W. R. Brewer Leaves Kellogg Company

The many friends of W. R. Brewer in the telephone field will be interested to know that Mr. Brewer left Kellogg Switchboard & Supply Com-

W. R. Brewer

pany January 1 to take up new work.

Mr. Brewer finishes his 12th year with the Kellogg Company, and his aggressiveness and conscientious endeavor have been much appreciated.

Digging Pole Holes in Winter

Everybody will admit that pole holes should be dug when the ground is not frozen, but everybody knows that emergencies necessitate the digging of such holes in freezing weather.

The diggers make slow progress, because pole-hole excavators cannot be used. Picks can be used only on the first few inches of frozen soil.

Low-freezing dynamite, suitable for use in the open, in winter, is becoming popular with hole crews. It takes much less time and labor merely to put down a two-inch bore hole in frozen earth than to dig a twelve or fifteen-foot hole. The stick or half stick of dynamite is pushed to the bottom of the bore hole, tamped in (sometimes with snow) and fired with cap and fuse. It is then a quick and easy operation, after the soil has been broken up and loosened by the shot, to dig out the hole to required size.

There is little danger of unduly loosening up the sides of the holes, when the ground is frozen. But even if an occasional hole is broken out a little too wide, it can usually be depended upon to freeze up solid again over night.

Contractors' crews are using dynamite quite freely now for winter pole-hole work.

Many Camps Cut Telephone Poles

More than a hundred camps, some situated in the most inaccessible portions of the state, strung along the south shore of Lake Superior and scattered through the country that makes up the "tip of the Michigan mitten," are this winter felling the straight, towering trees that later in the year will carry hundreds of miles more of the singing telephone wires over which will be handled the business of a commonwealth.

It has been announced that the state's telephone companies, particularly the Michigan State Telephone Company, will this year spend millions of dollars in extending and improving their service, and that 37,000 Michigan cedar poles will be required by this company alone.

Thousands of woodcutters are wielding ax and saw, hundreds of teamsters, cooks and cookees are singing at their work of moving this forest to river and railroad, and in the spring a hundred streams and a score of rail lines will hurry the poles to points from which they can be drawn by telephone construction crews.

It might here be said that this is Michigan's biggest year in the woods in many.

Mansfield Exchange to Be Reconstructed

The Mansfield Telephone Company, Mansfield, Ohio, on November 1, 1919, purchased the property of the Central Union Telephone Company in Mansfield and vicinity for $109,150.00. Since that time the two exchanges have been operating as a consolidated system by means of trunks between the former Independent and Bell exchanges.

A contract has been let for the complete reconstruction of the building of the Mansfield Telephone Company. Plans are under way for the rehabilitation of the outside plant and its adjustment to carry all of the outside system of the former Central Union Telephone Company into the central office of the Mansfield Telephone Company.

In the near future, modern central office equipment will be purchased to operate the system of the Mansfield Telephone Company in one central office.

Gustav Hirsch of Columbus, Ohio, is consulting and chief engineer for the Mansfield Telephone Company.

Wisconsin Fixes Wage of Operators

An order determining the number of hours for which telephone companies shall pay their operators under the minimum wage law has been sent by the Wisconsin industrial commission to all telephone companies in the state. This order supplements the original minimum wage order which became effective August 1.

The order provides that in exchanges which are maintained in private residences and conducted exclusively by the members of the household, the payment of a wage of 50 cents per month per telephone to the operators will be regarded as a compliance with the minimum wage law. Outside help employed in private residences, however, must be paid on the same basis as are operators in separate exchanges.

In exchanges conducted outside of the private residences different bases of pay are adopted for the day period from 6 a. m. to 10 p. m. and for the night rest period from 10 p. m. to 6 a. m. For the day period it is provided that in exchanges with less than 200 telephones the operators shall be paid for 11 of the 16 hours on duty; in exchanges with between 200 and 219 telephones for 12 hours; in exchanges with 220 to 230 13 hours; in exchanges with 240 to 259 for 14 hours; in exchanges with 260 to 274 telephones for 15 hours, and in exchanges with 275 telephones or more for the entire 16 hours.

For the night rest period the order provides that the operator shall be paid for all of the time which is not included in the longest rest period which the operators get off at least two-thirds of the nights they are on duty. It further provides that in no exchanges shall the night operators be paid for a smaller number of hours for their work between 10 and 6 than is provided for in the following schedule:

Under 300 telephones, 3 hours; 400 to 499 telephones, 4 hours; 500 to 624 telephones, 4 hours; 625 to 749 telephones, 5 hours; 750 to 874 telephones, 6 hours; 875 to 994 telephones, 7 hours; 1,000 and over the full 8 hours.

In a letter which the commission is sending with this order to all telephone companies, it explains that night operators are not required to begin work at 10 p. m. and conclude work at 6 a. m. The order merely provides that the pay before the 10 and after 6 shall be on a different basis than during the rest of the period. It also states that it will take up the question of whether a modification in the women's hour of labor law is not desirable in order to make it unnecessary for night operators to begin work or end work at an unseasonable hour of the night.

Clever Dunton Letter Boosts "Nokorode" Sales

The M. W. Dunton Company is sending out to the trade a four-page combination circular and letter so attractive that it is bound to increase the sales of "Nokorode," the company's remarkable soldering paste and salts. The letter, on the first page of the folder, calls attention to the selling plan and the method of helping dealers. The two inner pages describe and illustrate the prepared advertising material, display cases, etc., supplied. Soldering kits for general use, and the well-known booklets "Soldering Kinks" and "How to Solder" are also described.

Colonel Carty Tells War "Secrets"

At a luncheon of the New York Electrical League at the Hotel McAlpin on November 12, Colonel J. J. Carty, D.S.M., officer of the Legion of Honor (French) and vice-president of the American Telephone and Telegraph Company, was the guest of honor and made the principal address.

The colonel told of one of the most serious problems that confronted the Signal Corps on both sides of the Atlantic during the war. There was the constant danger that the trans-Atlantic cables would be cut by submarines. If this had been done, it would have meant that Washington would have been cut off from all communication, not only from the Allied capitals, but also from our own overseas troops.

The seriousness of such a contingency is obvious, and the best engineering brains of the country were turned on the problem. Powerful radio stations were erected at various points along the French and American coasts. Those on our coast were connected by wire direct with Washington.

These stations were within easy range of each other and, had it become necessary, messages would have been telephoned or telegraphed from Washington to one or more of the greater coastal radio stations, whence they would have been sent overseas far above the heads and beyond the reach of lurking U-boats. It never became necessary to fall back on the radio, for our Navy was entirely successful in subduing the undersea menace. As a matter of fact, two cables were actually cut, but they were unimportant ones,—one to Newfoundland and one to Southern Europe,—and did not interrupt seriously the steady exchange of messages.

Another interesting achievement which the colonel described arose from the desire of the army chiefs to devise a means whereby messages could be sent by cable or telegraph in plain English without the use of code, which not only delays the message on account of time consumed in coding and decoding, but which also increases the likelihood of errors in transmission. It was known that the enemy could tap our telegraph and even our cable lines, so that some means had to be evolved whereby the message would be unintelligible while in transmission, but would be received in English.

The solution of this problem lay in the perfecting of what Colonel Carty referred to as the cipher machine. By means of this machine, a message received in code on the printer telegraph would be run through the machine and come out in plain English. This machine was not perfected in time to be of service in France, but it was put into successful use on the lines from Hoboken to Washington and from Washington to Newport News.—*New York Telephone Review.*

Proposed Telephone Between Finland and Sweden

There has lately been much discussion concerning the necessity of telephonic communication between Finland and Sweden. There is a Helsingfors-Reval telephone line, under the Baltic, and up to three years ago there was also a Helsingfors-Petrograd line; but though not far distant, Abo and Stockholm have never talked to each other. There are two different routes for a Helsingfors-Stockholm line: By Tornea or by cable to Abo. The first would necessitate a line 1,800 kilometers (1 kilometer = 0.621 mile) in length, and this implies an exceedingly strong apparatus. In addition, an entirely new copper wire would be required from Vasa to Tornea, costing, it is estimated, 1,500,000 marks (1 mark = 19.3 cents at the normal exchange rate; for the quarter ended January 1, 1920, its value was given as 3 cents in the U. S. Treasury circular on values of foreign coins). On the other hand, the undersea line between Abo and Stockholm would be only 100 kilometers long, but "the cost of it," remarks a Helsingfors business man, "would be some millions, and, moreover, it would be a year or two before the cable could be procured from America or England."

"Technically," says a local newspaper, "the plan is possible in any case. The route by Abo affords many advantages. A private firm can hardly build so expensive a line, but if the States of Finland and Sweden together would defray all the expenses, the scheme might soon be carried out."

Company Makes Progress On $8 a Year

The telephone company at Paxton, Ill., is erecting the first fireproof building in that city, to be used for offices and exchange. It is located at the corner of Market and Center streets, is two stories and absolutely fireproof, being of steel, brick, concrete and building tile. The only wood connected with it is in the windows. The city lines of the company have been almost entirely rebuilt in the past year or so, and the plant will be strictly up to date when the installation of the exchange is complete. Many farmer lines are served by the local concern.

The telephone company in Paxton charges but $6 per year, twelve months, for residence service and $8 per year for business houses.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

G. W. Cummings, telephone supervisor of Chicago's department of public service, who was suspended for a brief period because of political complications, has been reinstated.

David R. Forgan, president of the National City Bank of Chicago, has announced the appointment of Clifford Arrick as vice president of the bank, effective April 1. Mr. Arrick has been associated with the Bell Telephone system for the last twelve years, but will hereafter devote his entire time to the bank work. Mr. Arrick started his business career at 15 as a page in the United States senate. Later he was with the U. S. geographical survey and still later was private secretary to W. H. H. Miller, attorney general under President Harrison. At the close of that administration and afterward Mr. Arrick was with Senator Elkins of West Virginia. During the Spanish-American war Mr. Arrick was a major and paymaster of volunteers. In 1912 he came to Chicago and has been associated since then with the Bell Telephone interests.

Nathan Corning Kingsbury, first vice-president of the American Telephone and Telegraph Company, and one of the recognized experts of the country on telephone operating problems, died suddenly of heart disease on Saturday morning, January 24, at his home, 39 East Sixty-fifth street, New York City. He was at his office as usual on Friday and appeared to be in his usual health. Death came peacefully while he was sleeping. The funeral was held Monday afternoon at two o'clock at the Collegiate Church, Forty-eighth street and Fifth avenue. Born at Mentor, Ohio, July 29, 1866, Mr. Kingsbury received a course of elementary instruction in the public schools of Constantine, Michigan, and then went to New York City, where he worked

Nathan C. Kingsbury

for a time in a general housefurnishing store. In 1882 he went to Idaho, where, at Hadley, he became a clerk in the post-office, and later was "printer's devil" on the Wood River *Times* of that place. He was in the railway mail service for a while and then returned East and studied at Oberlin College. Later he took a law course at the University of Ohio at Columbus. He was admitted to the Ohio bar upon graduation, and became general counsel for the Jeffrey Manufacturing Company, of Columbus, which position he held until 1906, when he was made vice-president of the Michigan State Telephone Company, with headquarters in Detroit. He became president of that company in 1907, and during his several years in its service its lines were extended and the service was placed on a very efficient basis. During this period he also served as vice-president of the Harris Trust and Savings Bank of Chicago, which position he held until January 1, 1911, when he became vice-president of the American Telephone and Telegraph Company, and removed to New York City. He was elected first vice-president of that company in June, 1919. He was prominent in negotiations conducted between Bell and Independent operators. He continued as director of the Michigan State Telephone Company and was also director of the American Sugar Refining Company, National City Bank and Chase Securities Corporation of New York, and the Harris Trust and Savings Bank of Chicago. Mr. Kingsbury was a member of the University, Metropolitan, Union League, Riding, Bankers, New York Press, Automobile Club of America, and the Blind Brook and Greenwich Country Clubs. He was married to Miss Lillian B. Prescott of Duluth on June 6th, 1893. He is survived by his widow and one daughter.

E. C. Blomeyer, president of the Texas Telephone Company of the Texas Independent Telephone Association, is assisting the United States Independent Association in the preparation of the national advertising service that organization is now furnishing many member companies, according to the announcement of President F. B. Mackinnon in a letter to members on January 13.

News From the Field

ARKANSAS

The City Council of Stephens has passed an ordinance taxing the telephone company 50 cents on each telephone pole in the business district of the town and 25 cents on every telephone pole in the residence district.

A new switchboard capable of handling 800 telephones, and a new outside cable system, are being installed by the Southwestern Bell Telephone Company at Mena.

ILLINOIS

The State Public Utilities Commission held a hearing on the application of the Wabash Valley Telephone Company for authority to increase its telephone rates in Paris, Vermilion, Elbridge, Redmon, Chrisman, Metcalf, Horace, Marshall and West Union and vicinities. After the hearing the commission took the matter under advisement. The commission also heard the joint petition of the Wabash Valley Telephone Company and the Central Union Telephone Company for approval of purchases by the Wabash Valley Telephone Company and sales by the Central Union Telephone Company of the Paris exchange of the Central Union Telephone Company and authorizing the issue of capital stock and first mortgage five per cent bonds by the Wabash Valley Telephone Company and acquisition and holding of the same by the Central Union Telephone Company. On conclusion of the hearing the commission also took this matter under advisement.

The Central Union Telephone Company, through the local manager, O. F. Clark, has purchased a site for an exchange and office in Urbana. The property at 212 West Elm Street was bought from Sarah Ann Gere, and work on the erection of the building will be started as soon as the weather opens up.

A hearing on the application of the Winnebago Telephone Company, for authority to increase its rates for telephone service in Rockford, Durand, Pecatonica, Rockton and Winnebago was held by the state public utilities commission. After the hearing the commission took the matter under advisement.

At the regular meeting of the telephone patrons of the Palmer district held at the opera house, 108 subscribers presented a signed agreement to have their telephones removed if the telephone company refused to grant the concessions asked for, namely better service and a resumption of the rates and tolls in effect prior to those rates established January 1, 1920. A committee consisting of Louis Sellback, J. V. Corn and H. F. Beckmier were appointed to arrange with the Morrisonville exchange for a meeting at the earliest possible moment.

A representative of the state public utilities commission was in Murphysboro and conducted a hearing as to the application of the Murphysboro Telephone Company for permission to increase rates. Quite a number of men from neighboring cities and towns were in attendance at the hearing. The commission granted the company a temporary order permitting rate increases.

The Lincoln Telephone Company has filed an application with the state utilities commission for a raise in the rates. In a statement made Wednesday it was said that in a general way, the raise asked would be equivalent to approximately $12 per year or $1 per month on business telephones and 50 cents a month or $6 per year on all residence telephones, both party

and private lines. There is also an elevation on the rural line of $3 per year, but this will be nullified by prompt payment of dues, it is said. This in a general way, is what is being asked. Whether or not the state board will authorize the raise is yet to be decided.

Articles of incorporation were filed with Secretary of State Louis L. Emmerson by the Woodhull Village Telephone Company of Woodhull. Its purpose is to maintain and operate a telephone line or exchange. The capital stock is $2,925. The incorporators are: G. E. Swanson, C. E. Houghton, A. B. Cox.

In spite of the fact that the telephone rates in Paxton are among the lowest in the state the company has been able this year to construct a beautiful two-tsory, fire-proof building to be used as offices and exchange for the entire company. The building is located at the corner of Market and Center Streets and is absolutely fire proof, being built of steel, brick, concrete and tile.

Orval Roby and James Cullen were elected directors of Gay's Mutual Telephone Company at its annual meeting, to succeed R. J. Farley and P. W. Waggoner. Scot Young was elected president to succeed C. O. Glasscock.

The annual meeting of the stockholders of the Maroa Telephone Company was held. I. G. Linville, was elected director to fill the unexpired term of the late M. R. Alsup and D. N. Gray and J. B. Shaw were re-elected directors for the full term of three years to succeed themselves.

The Strasburg Mutual Telephone Company held its annual stockholders meeting. Jas. F. Kull was elected president to succeed himself, and he was also re-elected a director of the company. Nelson Spurgin was elected vice-president, and H. O. Spannagel was elected a director, to succeed H. G. Rincker. Wm. W. Engel was re-elected secretary and Henry Faster Jr., treasurer. H. O. Spannagel and Nelson Spurgin were selected as a committee to find a suitable location for the central office, as the lease on the present location will soon expire.

The stockholders of the Atwood Mutual Telephone Company held their annual meeting. C. D. Greve, Oscar Beaty, Hans Heit and J. E. Leachman were elected directors. The directors organized by electing C. D. Greve, president; Oscar Beaty, vice-president; S. C. Rich, treasurer, and Alex Bercher, manager.

Farmers in the vicinity of Moweaqua who live in this county have organized a telephone company and have incorporated. The name of the new company will be the Moweaqua Farmers' Mutual Telephone Company. The capital stock of the concern is not given as it is a mutual company. The first board of directors is composed of R. E. Wetzel, W. P. Sanner, Robert F. Manley, J. Will Workman, M. S. Ayers, A. M. Burgener and Jacob Bilven. The work of the organization is to proceed' as rapidly as possible and the necessary steps looking to the building and equipping of the exchange will be made with all possible speed.

The Central Union Telephone Company, through the local manager, O. F. Clark, has purchased a site for an exchange and office in Urbana. Work on the erection of the building will be started as soon as the weather opens up. The building will be one story high and similar in appearance to the automatic office in Champaign, which is to be enlarged soon by an addition on the adjoining lot. When the Urbana building is completed it will house both manual and automatic equipment. There is no manual office in Urbana now, and when an Urbana subscriber calls an Urbana number, the call must be trunked through the Champaign office. With the new plant in operation, local calls in Urbana will be handled through it.

The Adamsville Telephone Company recently elected officers for the year. These officers follow: President, J. W. Elsea; vice-president, V. H. Spicer; secretary, E. C. Jordon; treasurer, C. A. Geyer; business manager, C. O. Hardy and wire chief, O. B. Vinsel.

At a recent meeting of the Seward Telegraph Company, the officers were re-elected: William McDonald, president; Hugh Smith, secretary, and Edward Spielman, tresaurer. The directors are William Harris, William Whitney, and Al Stanley. Mr. Stanley was elected to succeed Hiram Myres, who will move next month to Pecatonica.

At a meeting of the directors of the Stephenson County Telephone Company held last evening, Chas. D. Knowlton, Jr., was elected a director to succeed his father who died recently.

The annual meeting of the Farmers-Bluff Telephone Company was voted to do away with the incorporation which will eliminate a great deal of unnecessary red tape in running the business. The company will run under a co-operation plan. In the election of officers the following were chosen for the officers: President, C. A. Johnson; vice-president, C. T. Bennington; secretary, C. H. Kenady; treasurer, F. A. Clark.

INDIANA

The directors of the Uniondale Rural Telephone Company have held their first meeting since the recent reorganization of the company, involving the exchanges at Ossian, Zanesville and Uniondale. The company now serves 653 subscribers. The directors announced plans for the installation of new equipment at Ossian. The old officers of the Uniondale Company were re-elected, as follows: President, C. O. White; vice-president, Charles Dean; secretary, J. W. Keplinger; treasurer, Cliff R. Likpey; manager, G. F. Hoopengardner.

A meeting of the business men of Berne was held relative to the organization of a new telephone company. It was announced that more than the required amount of signers had been obtained and suggested that the company be capitalized at $50,000. The stock is to be limited and to sell at $100 a share. A committee was appointed to draw up articles of incorporation.

A meeting of the directors of the Home Telephone Company of Manchester was held in the office of Treasurer John H. Leming. A contract was made for the year 1920 with A. M. Smoot as manager and lineman. A new book of stock certificates was ordered to accommodate the new stockholders who are constantly coming in, and a directory was ordered printed in connection with several other exchanges in neighboring towns. New insulators, brackets and other supplies were ordered, for use in repairing the present lines and building new ones.

The Woodburn Home Telephone Company has incorporated for $25,000 naming the following incorporators: Levi Klopfenstine, Solomon L. Husted, William A. Basting, Joe H. Gustin and John G. Shumacker. All of the incorporators are residents of Woodburn.

Fairview Co-Operative Telephone Company, Hamilton County, changed its name to Atlanta Telephone Company.

The members of the Dunlap Telephone Company met with about 20 stockholders present. Directors were elected as follows: John Lower, secretary and treasurer; George Rhodes, vice-president; Jacob Weir and David Jenner, directors. Moses VanScoik was elected president but was not

present at the meeting so it is not known whether he will take the position or not. A dividend of seven per cent for the year 1919 was declared.

At a meeting of the stockholders of the Uniondale Telephone Company the following officers were elected for the ensuing year: President, C. O. White; vice-president, Charles Deam; secretary, J. W. Keplinger; treasurer, Cliff Lipkey and manager, G. F. Hoopengardner.

The annual meeting of the stockholders of the Avilla Mutual Telephone Company held at Avilla recently was largely attended. The company organized in 1913, now has 385 subscribers, owns the building in which the exchange is located and is giving its patrons first class service. It is owned by about one hundred citizens of Avilla and the immediately surrounding country, and its estimated value is $16,000. A six per cent dividend was declared yesterday. Its officers are Thomas Kelhan, president; Joe Kraus, vice-president, and Glen E. Thrapp, secretary and treasurer.

The Hazleton Telephone Company today filed a petition with the Public Service Commission asking permission to increase its rates.

The Winona Telephone Company serving Winona, Hamlet, Knox, Francesville and other subscribers, and the Greenfield Telephone Company petitioned the public service commission to investigate their condition and to establish rates sufficient to yield proper returns on their investments.

Paul P. Haynes, of the Indiana public service commission, opened a public hearing at the Chamber of Commerce in Terre Haute on the petition of the Citizens' Independent Telephone Company, for an increase in rates. The merger of the petitioning company and the Central Union Telephone Company is before the commission, and, it is said, if the petition for increased rates is denied the effort to consolidate the companies will be abandoned. The increase in rates proposed is 75 cents a month for home telephones and 60 and 72 cents for business establishments. It was announced at the opening of the proceedings that the valuation placed on the two properties by the experts of the companies had been reduced by the commission's engineers from $1,868,000 to $1,518,000. W. F. Sloan the company's expert, was one of the witnesses. The city and the Chamber of Commerce are not taking any part in the hearing, although W. J. Whitaker, city attorney, was present as a representative of the city.

The Camden Co-operative Telephone Company held their yearly meeting. G. M. Harrison was elected general manager and Otto Sterling to take the part as trustee in Isaac Peyton's place, Mr. Payton having held the office for nine years. Ten dollars dividends were declared for each stockholder.

The directors of the Citizens' Telephone Company of Fairmount, met and elected the following officers: President, George Felton; vice-president, Earl Morris; secretary-treasurer, J. A. Roberts.

KENTUCKY

There have been numerous rumors to the effect that the Home Telephone Company would make no effort to rebuild its lines in Mercer on account of the expense. This report is without foundation. While the damage will probably reach $15,000, the repair work will be completed as rapidly as possible with as little inconvenience to patrons as possible. Two cars of new telephone poles have been ordered and much other material. The local company is one of the few telephone companies in the state that has no bonded indebtedness and is in better financial position to repair its lines than probably any company in Central Kentucky.

The Columbus Home Telephone Company, Columbus, Ky., has been incorporated by R. L. Edmond, L. J. Perkins and Claude Mercer.

The Home Telephone Company, of Hickman, sustained so much damage in the recent spell of ice that the office is still closed and the entire system is temporarily out of business. Lines, including wire and many poles, are down in great measure over both the town and county and Manager A. D. Davis estimates that it will cost $8,000 to put them back in working order. Nothing will be done toward making repairs for the time being or until favorable weather, as practically the entire system will have to be rebuilt.

The Warsaw Telephone Company, changed hands when the property was sold by Hon. R. B. and Mrs. Sally Brown to Leonard N. Bradley. The sale price of the business is unknown. The new owner took charge of the business on February 1. The exchange will be moved and probably located near Mr. Bradley's home on High Street. It is the purpose of the new owner to improve the service, both locally and for long distance and no labor or expense will be spared to that end. The service from here to Cincinnati will be good at all times after the changes in the lines that are contemplated are effected, and the same applies to the Glencoe and Sparta lines. The present system is an old one and badly needs repairing in several places. New poles will be put in where needed and a great deal of new wire will probably have to be put in place as much of the old wire is badly rusted and about worn out. In order to effect the changes that are necessary to bring about the improvements desired, the new owner announces that it may be necessary to make a slight advance over the prevailing telephone rates, but that each subscriber will be notified by letter in case this is found necessary and a new scale of rates adopted.

MICHIGAN

Eaton county has four of the 47 Michigan cities and villages that will be affected by the proposed elimination of the present double telephone service at these points, by which the territory of the Citizens' Telephone Company will be in control of the western part of the state surrounding Grand Rapids. The Citizens' Company will give up to the Michigan State Telephone Company 31 towns, including Bellevue, Dimondale, Nashville, Potterville and Vermontville.

Michigan municipalities propose to stand firmly against any increases in the present temporary rates fixed by the public utilities commission for the Michigan State Telephone Company for all of its exchanges in the state. This was decided at a conference of representatives of cities with Attorney General Alex J. Groesbeck. The municipalities representatives claim that when the temporary rate order was promulgated by the utilities commission, effective last August, it was the distinct understanding that such rates should continue until a complete inventory and appraisal of all the property and business of the telephone companies was completed and the commission was prepared to make a permanent order on telephone rates throughout the state. However, it is recalled that the Michigan State Telephone Company did not enter into any agreement at that time which would prohibit it from making the application now on file with the utilities commission for an increase in the temporary rates. As a matter of fact,

the company did object to the last to the temporary schedule, complaining that it would not meet the deficit in revenue which it was facing at that time.

At the request of officials of the Automatic Home Telephone Company, a committee of business men from the Pontiac Chamber of Commerce met with them in conference for a discussion of the telephone problem and to prepare for matters to be discussed at a meeting between representatives of the various farmers' lines in the county and officials of the Automatic company. At the meeting the telephone company was urged to arrange any proposals they had to make in a definite and concrete form so that a solution of the problem to the best interests of all could be reached without having the next meeting result in a mere discussion of complaints without reaching some definite conclusion.

With a gain of 559 new stations during 1919 which averaged statistics show to indicate a growth in population of practically 6,000, the Michigan State Telephone Company, through its Pontiac branch, has already entered into an expansion program involving expenditure of $310,000 and aimed to provide for not only 1,000 new telephone stations in 1920 but also future needs in every part of the city.

The fifteenth annual meeting of the Grand Ledge Telephone Company was held and, with one exception, the directors were re-elected. Mrs. Clark Smith of Watertown township was elected to succeed G. H. Every, secretary-treasurer and general manager for the past 10 years. Other directors are: John Brunger, C. P. Brunger, A. G. Aldrich, W. H. Odding, Claude H. Barton, Clark Smith, John W. Ewing and A. Nunn. The company has 1,196 telephones and a surplus of about $15,000, being entirely out of debt. There are 134 stockholders. A big dinner was served in the G. A. R. hall at noon to stockholders, employes and a few invited guests.

At the annual stockholders' meeting of the Muskegon United Home Telephone Company, J. B. Lockwood of Muskegon was re-elected secretary, and also chosen to fill the position of treasurer, heretofore held by the late Thomas Bromley, Jr. A. B. Clark, of Muskegon, was elected to the position of operating manager, also succeeding Mr. Bromley, who was both treasurer and general manager. All the remaining officers of the company were re-elected for the ensuing year. They are as follows: President, J. K. Flood, Hart; first vice president, Gardner T. Sands, Pentwater; second vice president, J. H. Moore, Muskegon; third vice president, W. A. Cartier, Ludington; chairman of the executive committee, J. G. Emery, Muskegon; secretary and treasurer, J. B. Lockwood, Muskegon; operating manager, A. B. Clark, Muskegon. Board of directors, Ola S. Bromley, Muskegon; W. A. Cartier, A. B. Clark, C. L. Churchill, Shelby; J. B. Conger, Grand Rapids; J. F. Denslow, Muskegon; J. G. Emery, J. K. Flood, J. H. Moore, William Munroe, Muskegon; H. S. Newton, Hart; G. T. Sands, C. E. Tarte, Grand Rapids; G. M. Welch, Detroit.

The Shiawassee Telephone Company of Perry elected new officers for 1920. President, B. E. Cummins; manager, Wm. Rothney; secretary, Frank Crawford; treasurer, P. E. Cummins; directors, Leslie Clark, Wm. Rothney, Henry Brandt, Owen Carlton, Fred Hunt, B. E. Cummins, Frank Crawford, Mart Van Warmer and Wm. Horton.

At a meeting of the directors of the Farmers' Telephone Company at Litchfield the following officers were elected: President, W. S. Adams; vice president, W. W. Buell; secretary, J. D. Hawkes; treasurer, S. A. Doty. S. A. Doty was elected manager.

MISSOURI

At the annual meeting of the Farmers' Co-operative Telephone Company at Ozark Grant Gooch was re-elected president; U. S. Bellen, vice president, and U. S. Stine, secretary and treasurer. E. H. Hains and Mrs. Nora Harris were re-elected to operate the central office of the company in Ozark the present year. Service will be given day and night every day of the week. The past year has been the most successful in the history of the farmers company. Wilson Estes, a blind man, operates one of the company's offices at Cassidy.

The Jasper Telephone Company has given notice of an increase of rates, single lines from $1 to $1.50 a month, and two party lines from $1 to $1.25 a month. Other rates in proportion.

OHIO

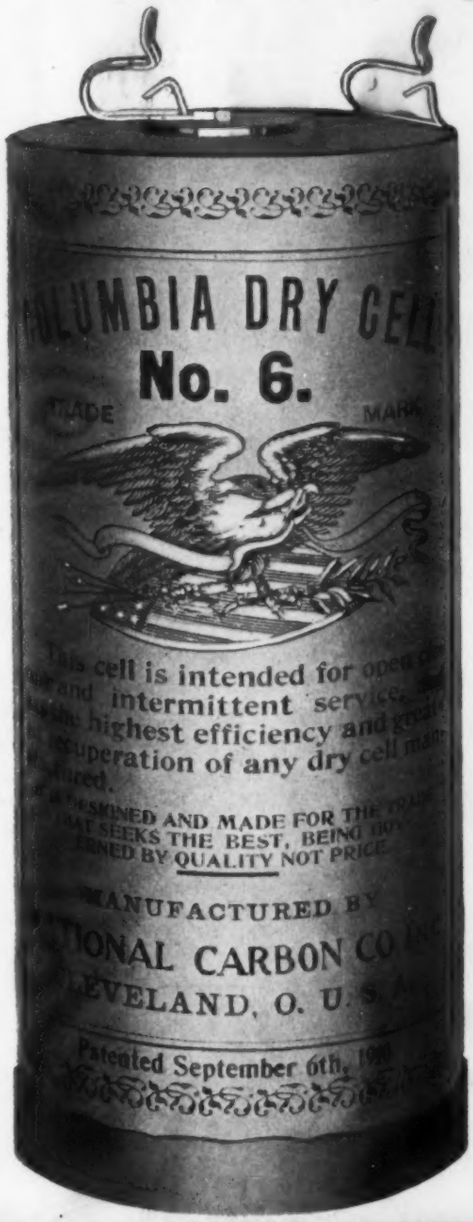
Local officials of the Central Union Telephone Company at Dayton and heads of other telephone companies of Ohio are of the opinion that should the public utilities commission investigate the proposed increase in rates, authority for the raise will be granted. However, dispatches from Columbus indicate that preparations for a refusal of the request for higher charges will be made should the demand come before the commission in the near future. The utilities commission is planning on taking the case to the higher courts to test whether or not companies in this state are privileged to increase their rates against the orders of the state commission, should the telephone companies do so. New rates which the local company desires to put into effect March 1 involve increases of 75 cents a month for two-party business phones, 50 cents for individual and two-party residence phones and 25 cents a month increase for extension and private branch exchange telephones.

Increased cost of furnishing service and necessity for funds to make extensions are given by E. A. Reed, general manager of the Central Union Telephone Company, as reasons for the schedule of increased rates for Columbus, effective March 1, filed with the public utilities commission yesterday. Increases are to be from $3.25 to $3.50 a month on individual residence phones; from $2.50 to $2.75 on two-party residence phones; from $7 to $8 on individual business phones, and from $5.50 to $6 on two-party business phones. Individual phones using measured service are to be increased from $2.50 to $2.75 for 60, instead of 50 calls a month. After 60 messages, the rate is to be 3, instead of 4, cents per message. "Notwithstanding the increases made during the past two years, from 1915 to 1919, the increase in revenues in Ohio was less than the increase in our expenses, due chiefly to the increased wages paid our employes," said Reed. "We also have filed with the commission a statement showing the yearly revenues, expenses and net income of our Columbus exchange, which clearly shows our urgent need for additional revenue." Under the new Robinson law, the commission may suspend rates pending an investigation as to reasonableness.

Efforts of the Central Union Tele-

Columbia Telephone Cells

"less cost per day of service"



EXTRA LONG LIFE makes the Columbia Gray Label supreme in telephone service. The secret of it is that the Columbia Gray Label never gets the fidgets between calls; it knows how to rest; it conserves its strength. The result—"less cost per day of service." Fahnestock Spring Clip Binding Posts no extra charge.

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Cleveland, Ohio San Francisco, Calif.

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14222₀

phone Company at Youngstown to secure an increase in rates has met with so many protests that the matter will be brought before a special meeting of the chamber of commerce directors this week, it was said Monday. The directors will determine whether organized opposition to the proposed raise in phone rates shall be made. Announcement that an increased scale has been asked from the state public utilities commission has resulted in scores of communications to the chamber of commerce and in urgent requests that all steps possible should be taken to prevent the new rates being made effective.

Directors of the Farmers' Telephone Exchange Company, Marietta, for the ensuing year were elected last week, as follows: John Huck, Charles Schimmel, J. M. Merritt, C. F. Shinn, H. P. McFarland, Daniel Wilking and George Mattern. The board has not yet organized.

The Marion County Telephone Company held its annual meeting in the office of the company on South Main street. The following directors were elected: H. B. Hane, Fred E. Guthery, W. G. Harding, F. A. Huber, John A. Schroeter, A. E. Cheney, A. J. Berry, S. E. Barlow, D. R. Crissinger, James F. Prendergast and J. G. Leffler. The directors organized by electing F. E. Guthery, president; S. E. Barlow, vice president; A. J. Berry, secretary, treasurer and general manager. The company reports a very satisfactory year's business.

TENNESSEE

The first report of the Cumberland Telephone and Telegraph Company to the law committee of the Memphis Chamber of Commerce under the agreement of the telephone company to undertake the improvement of its local service to a satisfactory point within 60 days and make weekly reports of progress, has been received by W. P. Armstrong, chairman of the law committee. The report covers the week ending Saturday, Jan. 31. The percentage of signals not answered in 10 seconds is given as 14 per cent; total force of operators at end of week 338; total additions during week to operators 8; total losses in operators during week 10; total students in school at end of week 28; total applications for operators' positions during week 48; total applicants accepted during week 19; net gain in stations during week 73. The total force at work is exclusive of students, as are also the losses and additions in operators.

Asking that the Alexandria Home Telephone Company be required to interchange toll and long distance service with the Gainsboro Telephone Company as has been done in the past, a petition was filed with the Public Utilities Commission by J. W. Parker and other stockholders of the Alexandria Telephone Company. The bill recites that heretofore a contract had been entered into between the two companies whereby long distance telephone service was furnished to the subscribers of the Alexandria Home Telephone Company by the Gainsboro company. This agreement was broken during the past month by the Alexandria company, although the Gainsboro company is ready to carry out its part of the agreement and the petition asks that the Alexandria company be required to continue this service as Alexandria is now completely cut off from the outside world in telephone service.

A charter of incorporation was issued to Nashville Telephone Employes' Community Store. The company is capitalized at $5,000. Incorporators are: W. C. Thomas, R. Knapp, C. F. McMurry, L. J. Cecil and W. C. McKinney.

The stockholders of the Trezevant Telephone Company held their annual meeting and elected officials for the ensuing year. A number of changes were made in the constitution and by-laws of the company. Rates were increased about 40 per cent to meet the increased cost of operation. The following officials were elected: President, M. F. Hurdle; vice president, W. F. Smith; secretary-treasurer, Dr. John G. Holmes; manager, Dock Foster. Directors in addition to the above officials: J. E. Bryant, H. L. Weatherford, E. J. Kearney, W. A. Younger, J. R. Williams and W. R. Cloyd.

The annual stockholders' meeting of the Obion County Telephone Company in Union City showed a very fine year's business.

TEXAS

Rapid expansion of Houston to the southeast and down the Ship Channel have made necessary the establishment of a new telephone exchange here. The Southwestern Telegraph and Telephone Company announces that within the next six months it will have completed and installed a telephone exchange in a building to be erected at Yoakum and Harrisburg boulevard. The new exchange will relieve the Preston exchange of 1,200 lines. Plans have been drawn for the new building and work will start at once. Equipment has been ordered. No name has been selected for the new exchange. This will be the fifth exchange in Houston.

C. A. Gates, vice president of the Southwestern Telegraph and Telephone Company, in his appraisal of the company's properties in Houston, fixes the reproduction cost of these properties at $7,221,845 and the reproduction cost, less depreciation, at $6,794,999. Mr. Gates' appraisal has been offered in evidence in the injunction suit of the Southwestern Telegraph and Telephone Company against the City of Houston, which is now being heard before Special Master Judge Julian Llewellyn.

The Bryan telephone exchange will in the near future make extensive improvements to its plant in the way of new switchboards, lines, etc. The city has outgrown the capacity of the present system.

At a joint meeting of the Sherman Retail Merchants' Association and representatives of the Grayson Telephone Company it was agreed that no objection would be made to the telephone company's request for a raise in rates, provided the people of Sherman are assured of better telephone service. The telephone company desires to raise residence rates from $2.25 to $2.50 per month and on business phones from $4.50 to $5 per month, the telephone company agreeing to expend all of the revenue thus derived in increasing the wages of operators and electricians. The matter will come before the City Commission.

WISCONSIN

With the installing of the measured telephone service the Wisconsin Telephone Company anticipates 30,000,000 less phone calls yearly. Most of the calls that will be cut out by the new system are superfluous ones," said William R. McGovern, general manager of the company. "We average about 400,000 calls a day, but some days they run as high as 650,000. We expect a reduction to between 75,000 and 100,000 calls daily. That the nickel telephone had come into sudden demand was denied by Mr. McGovern.